AMITY UNIVERSITY
UTTAR PRADESH

PRESENTS

FUTURE LEARNING ASPECTS OF MECHANICAL ENGINEERING

FLAME
2018

1st INTERNATIONAL CONFERENCE

OCTOBER 3rd – 5th, 2018

Editor
Prof. (Dr.) Basant Singh Sikarwar

Organised by
Department of Mechanical Engineering
Amity School of Engineering and Technology

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1st International Conference on Future Learning Aspects of Mechanical Engineering

FLAME
2018

3rd – 5th October, 2018
Amity University Uttar Pradesh

Editor
Prof. (Dr.) Basant Singh Sikarwar

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AMITY UNIVERSITY AT A GLANCE

Amity University, the flagship institution of Amity Education Group, is India's no.1 ranked non profitable private University with a strong focus on research and innovation. It has been recognized as India's Best Research University' and 'Best University for Placements' by the Indian Education Awards 2015 & 2016 respectively and was also ranked amongst the top 200 universities in Asia by QS.

Amity has set a new standard of academic excellence in India by becoming Asia's only not-for-profit University to be awarded US Regional Accreditation by WASC Senior College and University Commission, USA-considered the Gold Standard of Accreditations globally.

It has also been ranked among the top universities globally by the Higher Education, the world's leading publication on higher education.

Amity is a leading global education group, established over 2 decades ago. Today, Amity is home to over 150,000 brilliant students across Pre-nursery to Ph.D. levels pursuing more than 300 Programmes in 60 diverse disciplines.

The Group is driven by its vision of building up a Global Knowledge Network providing globally benchmarked education. Today the Group comprises of 9 Universities; 25 schools and 10 international campuses across London, Singapore, Dubai, New York, Mauritius, China, Abu Dhabi, South Africa and Romania, amongst others.

With a focus on Outcome based education. Amity offers various programmes at bachelors, masters and doctoral level. University offers different programmes in Engineering, Bio Sciences, Architecture, Telecom, Arts, Journalism and Communication, Management, Humanities, Social Sciences, Education, Hospitality, Law, Insurance, Health and Allied Sciences, also Distance learning. The programmes offered at AUUP are based on Choice based Credit Based System and are designed to ensure holistic learning and aims at developing academic excellence, enhancing life skills and imparting experiential learning.

Amity's relentless pursuit of excellence is reflected in its steadfast commitment and continuing investment towards cutting-edge research and innovation. For instance, Amity in the last five years has filed over 850 patents, which as per the Annual Report of the Controller General of Patents, Government of India, is by far the highest number of patents filed by any Indian University. It is also engaged in conducting those funded by Bill & Melinda Gates Foundation, USAID, and LeverhulmeTrust, UK.

The University is also committed to bridge the gap between academics and industry. The in-house award-winning Incubator, which has nurtured over 100 companies and attracted over USD 40 million investments in the last few years, is a step towards that very end. These are just few of the reasons why Government of India recognized Amity as a 'Scientific & Industrial Research Organization' (SIRO).

In the field of management, the University has developed over 1,800 case studies in the past years that have been bought across 62 countries by over 4900 leading institutions and organizations like Harvard, Stanford, Oxford, McKinsey, and KPMG amongst others.

Amity has also established merit scholarship programme wherein scholarships have been awarded to over 25, 000 students. It is one of the few Universities in India to offer these bright students a choice of over 300 Degree programmes across 60 diverse disciplines.

Amity's career Resources team of 60 dedicated members ensures top-of-the-line placements and higher study opportunities for its students globally. Infact, Amity has facilitated over 27, 000 campus placements in the last years.

Today the Amity community of outstanding students has exceeded over 120, 000 alumini worldwide, who are successfully pursuing their career in top organizations or pursuing further studies at leading institutions in top global universities like Stanford, Oxford and Harvard.

Amity's unwavering focus on research and innovation, globally benchmarked infrastructure, and teaching pedagogy, has led to the University being awarded the highest 'A' grade accredition by NAAC (National Assessment & Accreditation Council) a distinction awarded to only 10% of Indian Universities.

In addition, Amity University Uttar Pradesh is proud to be the first Indian University to be accredited by The Institute of Engineering & Technology (IET, UK) for its Engineering programmes. Further, AUUP has also been accredited by the Accreditation Council for Business Schools & Programmes (ACBSP, USA) for its Management programmes; accredited by Royal Instutute of Chartered Surveyors (RICS, UK) for Real Estate & Construction Programmes; accredited by European Foundation for Mnagement Development-Technology Enhancement Learning (EFMD-CEL, Belgium) for online MBA Programmes; accredited/ certified by UNWTO, TedQual, Andorra for Travel & Tourism Programmes.

This pursuit of excellence has also resulted in Amity Institute being ranked among the top institutes in India in areas of Management, Engineering, Biotechnology, Hospitality, Law, Insurance and Telecom in various prestigious surveys conducted by leading publications.

DEPARTMENT OF MECHANICAL ENGINEERING

Amity University Uttar Pradesh NOIDA Campus

The Department of Mechanical Engineering at Amity University, Uttar Pradesh started right at the inception of the campus in 2003 and has been offering B.Tech Mechanical Engineering, B.Tech+M.Tech (integrated) M.Tech (Design Engineering), M.Tech (Thermal and Fluid Sciences), M.Tech (Mechatronics), M.Tech, (Industrial and Production Engineering) and Doctoral Research Programmes. The department faculty members are also offering courses for the benefit of working professionals. The students of all tiers have access to both expert faculty members in the department and institute supported industry engagement opportunities. The department has extensive laboratory and infrastructural facilities for teaching, training and research. Our faculty members have received external funding from government agencies (DST/ SERB, DAE, UGC/ RA, BIRAC, DBT, SERC, DRDO) and industry sponsored research projects (Amber Enterprise, Tex Incorporation, Advance Valve, L&N Structural Engineers).

Research interests of the faculty members in engineering and material science, includes CFD analysis of thermal & fluid systems, thermal energy storage technologies, heat transfer augmentation techniques, nano-scale transport phenomena, fluid-structure interaction, wind engineering, condition monitoring, bluff-body flows, parallel computing, renewable energy planning & commercialization, green buildings, multi-criterial evaluation, energy modeling & optimization for micro-grid, FE/FV based thermal-mechanical analysis in manufacturing processes, sheet & bulk metal forming, constitutive modeling development for hot deformation of materials, CAD/CAM, product design & realization, additive manufacturing, high speed machining & process optimization, micro and nano-machining, mechatronics and artificial intelligence, multi-objective scheduling, mechanical behavior of composites & biomaterials, thermodynamics of materials and materials for energy storage applications. Prominent foreign visitors visit to the department for delivering expert lectures. However, our students visit in our foreign campus in 3C and study aboard program to attained expert talk of foreign faculty members.

For more details about the department, please visit the website:

http://amity.edu/aset/departmentsFaculty.aspx?iInstituteId=24&iintueDepartmentId=6

Prof. (Dr.) Basant Singh Sikarwar

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Dr. Ashok K. Chauhan
Founder President, Ritnand Balved Educational Foundation (RBEF)
(The Foundation of Amity Institutions and the sponsoring Body of Amity Universities)
Chairman, AKC Group of Companies

Dr. Ashok K. Chauhan, a renowned educationalist, industrialist, philanthropist and immensely successful entrepreneur in Europe for over three decades. With an aim of bringing together some of the brightest minds from all arenas he established the not-for-profit Ritnand Balved Education Foundation He has provided a platform to youngsters by giving them global level professional education while instilling in them a sense of values.

Today, Dr. Chauhan's vision has translated into internationally benchmarked campuses that have come to epitomize the Amity Education Group. Currently the group is comprising 9 Universities, 25 schools and preschools and 150+ institutions, are home to over 150,000 students pursuing 300 programmes from pre-nursery to Ph.D. across campuses spread over 1000 acres. This tremendous and unmatched growth of Amity is a culmination of hi-tech campuses, dedicated faculty and unparalleled corporate interaction.

Grounded to his dreams, he always believed in the policy of leading one eye on vision and one eye on implementation. It is therefore no surprise that Dr. Chauhan's innovative and far sighted strategies have transformed the education landscape of the country. He is the man who gave us the golden success mantra of four 'E's -Edge, Enthusiasm, Excellence and Execution in all walks of life.

CHANCELLOR, AMITY UNIVERSITY UTTAR PRADESH

Dr. Atul Chauhan
Chancellor, Amity University Uttar Pradesh
President, Ritnand Balved Educational Foundation
CEO, AKC Group of Companies

Dr. Atul Chauhan is the President of the not-for profit Ritnand Balved Education Foundation and the Chancellor of Amity University Uttar Pradesh. Dr. Chauhan is also the CEO of the AKC Group of Companies which has worldwide interests in the fields of plastics, healthcare and technology. Amity is a leading not-for-profit education group of India with over 150,000 students across London, Dubai, Singapore, New York, Abu Dhabi, China, Mauritius, South Africa and Romania, besides India.

Dr. Chauhan is a member of many government and statutory bodies. Born and brought up in Germany. Dr. Chauhan attained his higher education in the field of engineering and finance from University College London and London School of Economics.

His Vision is to create centres of thought leadership across the world, where faculty, scientists and brilliant students can explore and expand the frontiers of knowledge.

MESSAGE FROM MHRD MINISTER

I extend a very warm welcome to all the delegates of the 1st international conference on Future Learning Aspects of Mechanical Engineering (FLAME-2018). The conference is happening at a unique time where the world needs sustainable and affordable energy solutions to improve quality of life for billions of people in the emerging world. In a dynamic evolutionary world of today, where technology is evolving every second, it is highly desirable that we capture, comprehend and commercialize the innovations at an equally rapid rate. In view of the ever-growing trends in Thermal, Fluids, Energy, Robotics and Process engineering, this conference is the need of the hour.I am sure that the conference will provide an excellent opportunity for the researchers, academicians, industry experts, young professionals, scholars etc., to widen their knowledge domain, explore and exchange new ideas, provide different insights and deliberate on various significant topics of today's competitive world. Further, this Conference will also bring together the renowned experts from the core field and other allied areas to forge linkages and bonds for mutual research benefits.

I wish all delegates of FLAME 2018 an outstanding conference with unparalleled learning and networking. I hope that the participants have a unique experience at Amity University NOIDA.

I wish the conference a grand success.

Shri, Prakash Javadekar Ji
Union Minister of Ministry of Human Resource Development (MHRD), Government of India.

MESSAGE FROM CHIEF GUEST

Prof. (Dr.) K. Muralidhar
Dean of Faculty Affairs
Indian Institute of Technology Kanpur, India

Starting from the industrial revolution, mechanical engineering as a discipline has evolved over the years from emphasis on principles of mechanics to large-scale industrial applications. It has historically focused on subjects such as machines and engines, their performance and development of newer configurations. Developments in electronics, computers and lasers are now integrated with mechanical devices, yielding new levels of performance and service. Galloping trends in computers and information technology on one hand, and materials on the other, have profoundly impacted the profession, calling for a serious review of its outlook and activities.

Energy and environment constitute mainstream areas of interest of mechanical engineers. The present-day concern with shortages in energy resources and the quality of environment has pitched the subject to the forefront. Engineers are demanded solutions that call for imagination and ingenuity. The discussions on bio-fuels, hydrogen economy, fuel cells, gas hydrates and carbon-dioxide management have a societal angle on one hand, but technological solutions will call upon mechanical engineers to deliver the promise.

In terms of design and analysis, computational mechanics has attracted the greatest attention world-wide. It includes composite materials, structural analysis, fluids and turbulence, heat and mass transfer, multi-body dynamics, interfacial phenomena and optimization. The next era will require greater creativity in mathematical modelling, multi-scale simulation and ultra-fast computation of unstable systems in the engineered as well as the natural world. Validation of the models and theories against experiments is one of the enduring research targets. Classical measurements have paved way for non-invasive techniques using lasers, X-rays, gamma-rays, and ultra-sound. Applications are being developed for measurements using micro-waves, for example in the context of weather prediction. Other examples are seen in non-destructive testing of solid rocket propellants, void fraction measurements in steam-water flow, and process control in power plants.

Profound changes can be seen in the configuration of new-era machines. The interest here is in machines based on self-organizing smart materials, including generative processes, micro-fabrication and self-assembly. It includes the realization of the concept of error-free manufacturing, including the self-correcting nature of the shaping process, advanced metrology, rapid prototyping, and software development for CAD-to-product processes. Closely aligned with the subject is creating of textured surfaces that deliver interfacial properties of great significance.

The future of mechanical engineering can be stated in its complete generality as: The discipline will focus on developing cutting-edge technologies of inter-disciplinary nature on multiple scales. To this end, it will broaden its self-definition and be a continuing source of ideas to the industry.

In this background, It is pleasure to note that the Department of Mechanical Engineering, Amity University Noida Campus is organizing 1st International conference. I wish resounding success to the entire proceedings and health cross fertilization of ideas leading to joint research programs based on collaborative efforts

MESSAGE FROM GUEST OF HONOUR

I am pleased to know that that Amity University Uttar Pradesh is organizing the 1st international conference on Future Learning Aspects of Mechanical Engineering (FLAME-2018). The theme of the conference has been chosen keeping in view the changes happening in the technology domain and the need to learn the future technologies to remain relevant, innovative and sustainable. The technologies related to mechanical engineering has moved from Mechatronics to Internet of things, where the products and processes like turbines, wind mills, automobile to name a few have digital sensors collecting real time data on operations and performance parameters and sent to cloud where data analytics and business intelligence tools are analysing and controlling these systems for highest levels of efficiency and effectiveness. Mechanical Engineers and professionals have a big responsibility of meeting the energy demand for the fast growth of economy. With research in areas like bio fuels and other nonconventional energy on one side and better combustion and efficiency, lot is happening which is both exciting and challenging.

I wish the conference a great success and hope that deliberations will provide roadmap for the future learning aspects in Mechanical Engineering.

Prof. S K Garg
Pro Vice Chancellor and Professor
Delhi Technological University, Delhi
(Formerly Delhi College of Engineering).

MESSAGE FROM VICE-CHANCELLOR

Prof. (Dr.) Balvinder Shukla
Professor of Entrepreneurship & Leadership
Vice Chancellor, Amity University
Uttar Pradesh

It is a matter of great pride and privilege for me to share that **Department of Mechanical Engineering, Amity School of Engineering and Technology** is organising an International Conference on **'Future Learning Aspects of Mechanical Engineering' - FLAME 2018, supported by Deptt. of Science & Technology (DST), Govt. of India, Indian Society of Mechanical Engineering (ISME) and Siemens** from 03rd - 05th **October, 2018** at Amity University Campus, Noida, Uttar Pradesh.

FLAME - 2018 seeks to provide a stimulating forum for a broad blend of high-quality academic papers in order to promote rapid communication and exchange between researchers, scientists, and engineers in the field of mechanical engineering. The discipline of mechanical engineering is the mother branch of multiple inter-disciplinary areas such as Thermal and Fluid Engineering, Design Engineering, Automobile Engineering, Computational mechanics, sustainable and green manufacturing etc.

FLAME - 2018 will provide an opportunity to synergize the developments in these inter-disciplinary areas with the motive of exchanging ideas on the theories, technologies, applications and dissemination of knowledge. The conference will secure a common platform for eminent personalities in the field of research, academics and industry to witness, discuss and develop new ideas and concepts formulating solutions to problems in the field of mechanical engineering and allied areas. I convey my heartfelt gratitude to all the 800 distinguished researchers and scientists from India and abroad, for their meaningful contribution in the form of research papers on diverse mechanical engineering field. The Proceedings of this conference will surely be a good referral source to academicians, young enthusiasts and industry professionals from public and private sectors who strive to update their knowledge.

FLAME - 2018 will surely be an enriching experience for everyone with substantial scope of engendering innovative concepts and provide impetus in developing a problem-solving attitude. The sessions during the Conference shall be informative, interactive and valuable to all the participants and they will benefit immensely from the in-depth understanding and experience of eminent speakers from all over the world.

I take this opportunity to heartily welcome all the keynote speakers, scientists, guests and delegates from India and abroad for their participation in this conference and wish them a pleasant stay in Delhi/ NCR.

I am very proud of the remarkable efforts of the Mechanical Engineering Department Organizing Team for their remarkable efforts to organize this conference at such a large scale. It is only through such dedication and perseverance that one can achieve excellence.
Wishing FLAME 2018 a grand success!

MESSAGE FROM PRO-VICE CHANCELLOR

Prof. (Dr.) Sunita Singh
Pro-Vice Chancellor, Amity University, Noida

It gives me immense pleasure to note that Department of Mechanical Engineering, Amity School of Engineering and Technology is organizing its 1st International Conference - **FLAME - 2018** on the theme **'Future Learning Aspects of Mechanical Engineering' at Amity University Uttar Pradesh from October 3rd to 5th, 2018.**

As an educational institution, establishing a suitable platform for the research community, to interact with each other and to share the knowledge, can provide encouragement and support to research. I am confident that FLAME 2018 will provide an outstanding opportunity for mobilization of experts from various fields to exchange and share their ideas, experiences and research findings. The conference would touch upon various fields of Mechanical Engineering with emphasis on various challenges and corrective measures along with new developments in the area.

Research activities across all the engineering fields pave the way for the industrial world to strive forward with huge advancements. I am hopeful that considering the broad spectrum of the conference, the participants shall be inspired to develop and introduce new technological concepts that will help in bringing new headways in the field of Engineering.

I extend a warm welcome to all the speakers, researchers and delegates of the conference and wish that this conference will bring forth valuable outcomes.

MESSAGE FROM CO-PATRON

Prof. (Dr.) Abhay Bansal
Joint Head, Amity School of Engineering & Technology
Director, DICET & HoD (CSE)
Amity School of Engineering & Technology

We, at Amity School of Engineering & Technology have always been forerunners in undertaking endeavors that have an impact on society and provide a collaborative environment that facilitate flow of innovative ideas for overall development of our students. Keeping to the name of the institution, it is a matter of great pride that Department of Mechanical Engineering of Amity School of Engineering and Technology is organizing its first International Conference on Future Learning Aspects of Mechanical Engineering (FLAME - 2018) from 03rd – 05th October 2018.

In a dynamic evolutionary world of today, where technology is evolving every second, it is highly desirable that we capture, comprehend and commercialize the innovations at an equally rapid rate. In view of the ever-growing trends in Thermal, Fluids, Energy, Robotics and Process engineering, this conference is the need of the hour. I wish that the deliberations during the three-day conference touch upon the latest developments in the field and hope that this conference turns out to be a platform for new innovations. I congratulate the Department of Mechanical Engineering for organizing this conference and hope that the participants have three days of fruitful learning experience.

MESSAGE FROM CO-PATRON

Prof. (Dr.) Manoj Kumar Pandey
Joint Head
Amity School of Engineering and Technology

As the boundaries of different disciplines are diminishing very fast, so it becomes all the more important to synergize efforts of the professionals working in various fields of knowledge for updating new trends. The Conferences provide an opportunity to update professional caliber and equip us with the latest innovations in the field. With this mindset, the Department of Mechanical engineering, Amity School of Engineering and Technology is organizing its 1st International Conference on Future Learning Aspects of Mechanical Engineering (FLAME - 2018) from 03rd – 05th October, 2018.

I am hopeful that the conference would be very purposeful in offering resolutions to multiple issues in the field of mechanical engineering by providing a common platform for researchers and experts. The rich deliberations among the learned personalities in the conference shall help in fostering the growth of new technologies and ideas.

I wish the conference all success and congratulate the organizing team for putting relentless efforts.

MESSAGE FROM GENERAL CHAIR, FLAME -2018

Prof. (Dr.) Basant Singh Sikarwar
Head of Department, Mechanical Engineering
Amity School of Engineering & Technology,
Amity University Uttar Pradesh

I take great pleasure and pride to share that our Department of Mechanical Engineering is organizing First International conference on 'Future Learning Aspects of Mechanical Engineering,' FLAME 2018. The conference is scheduled from Oct 3-5, 2018 at Amity University, Noida. FLAME 2018 touches upon various significant topics in the field of Thermal, Fluids, Mechatronics, Control and Robotics, Material Science and Engineering, Solid Mechanics, Design, Manufacturing and Industrial, Automobile Engineering etc. The conference seeks to provide a forum for a broad blend of high-quality academic papers in order to promote rapid communication and exchange between researchers, scientists, and engineers in the field of mechanical engineering.

As the General Chair of FLAME - 2018, I firmly believe that the conference will serve as a pivot for the researchers, academicians, students and Industry. The Conference will witness deliberations, discussions and sharing of thoughts and ideas that will bolster the efforts to take up new challenges and initiatives in the field of mechanical engineering and allied areas. It's a matter of immense pleasure that Academicians from various IITs, NITs, central universities, State Universities and foreign universities, Industry stalwarts and Scientists from various reputed organizations will enlighten us with their knowledge and experience in the Conference.

As HoD-Mechanical Engineering Department, I take utmost pleasure to express heartiest congratulations to the Organizing Committee who has accomplished an arduous task in the most impeccable manner. We welcome you all for FLAME - 2018 and hope that your stay turns out to be intellectually stimulating and professionally enriching.

We are sure that FLAME - 2018 leaves long lasting memories and a strong legacy to emulate.

I am confident that every individual will be benefitted and feel enriched through this conference. I personally as well as on behalf of Mechanical Engineering Department wish FLAME - 2018 a GRAND SUCCESS.

MESSAGE FROM CONVENERS, FLAME - 2018

Prof. (Dr.) Gopal Nandan

Prof. (Dr.) R.K. Tyagi

With a great pride and honor, We take this esteemed opportunity to welcome you all to FLAME - 2018, international peer-reviewed, high quality academic conference and the first international conference on Future Learning Aspects in Mechanical Engineering on 3-5 October 2018 to be organized by the department Mechanical Engineering, Amity School of Engineering and Technology, Amity University Uttar Pradesh, India. The acceptance rate of papers was approximately 39%, inclusion of all accepted paper in Springer Book Series also indicate class of this conference. In the current context, the conference theme is very much relevant. We hope this international conference would provide a valuable platform for interaction among researchers and technologists from academia and industries.

The members of the organizing committee are very proud to host FLAME - 2018 and looking forward to welcome you in the conference. The distinguished delegates from around the world deserve sincere appreciation for their participation. We hope that you all will find the conference fruitful, enjoyable, valuable, and enriching the learning experience. We express our sincere thanks to members of advisory committee for their invaluable inputs for the conference. Finally, we would like to acknowledge all organizing committee members for their outstanding efforts and planning, without which we might not have such an excellent conference.

MESSAGE FROM ORGANIZING SECRETARY, FLAME-2018

Dr. Vikas Kumar

Dr. Rahul Sindhwani

We are delighted to invite the participants, delegates, students for the first International Conference on 'Future Learning Aspects of Mechanical Engineering' (FLAME), which is to be organinzed on 3rd - 5th October 2018 by Department of Mechanical Engineering at Amity University Uttar Pradesh, Noida.

It is our great pleasure and honor to be the Organizing Secretary of FLAME-2018. The conference includes all the aspects of mechanical engineering especially Design, Thermal, Industrial & Production and Interdisciplinary domains. We received more than 800 manuscripts and only 330 high impact manuscripts were accepted through a rigorous review process. The FLAME-2018 will witness three prestigious plenary sessions and sixteen keynote lectures from worldwide experts in their respective fields' along with thirty-four technical sessions.

We would like to express our sincere gratitude and appreciation for the significant efforts of the HOD (ME), faculty members, and volunteers of various committees and reviewers of the manuscripts. We would also like to express sincere gratitude to all the authors for their participation, invited speakers for sharing their knowledge and eminent chair persons for conducting the technical sessions. Once again looking forward to seeing you all and hope you will have a great time during the International conference FLAME-2018.

MESSAGE FROM CHAIRMAN, ISME

Dr. S. P. Singh
Professor (Mech. Engg.) IIT Delhi
Chairman, ISME (isme.iitd.ac.in)

On behalf of Indian Society of Mechanical Engineers (ISME), I congratulate the organizers of the 1st conference on Future Learning Aspects of Mechanical Engineering (FLAME-2018) which is being organized at the campus of AMITY University.

I am delighted to be a part of this conference with some of the functions being overseen by my ISME colleagues. I am also delighted to see that the university and especially the Department of Mechanical Engineering at School of Engineering and Technology has made elaborate efforts to gather participants working on various facets of Mechanical Engineering from India and Abroad. My heartiest welcome to all of you.

Indian Society of Mechanical Engineers is committed to the aim of promoting and advancing the art, science and practice of Mechanical Engineering. Such conferences and the interactions there on play a very vital role in these advancements. The society is in 42nd year of its completion. A lot of changes have undergone in the field and the face of mechanical engineering is quite evolved from the one which was two decades ago. New subjects such as Mechatronics, Bio-mechanics, Nano-mechanics. Micro-electromechanical systems, Rapid Prototyping, Micro-fluidics, Surface engineering, and Novel Materials development etc. are changing the face of mechanical engineering. It is one of the important purpose of such conferences and the aim of the society to keep our engineers abreast of such technologies. It goes very well with our theme that in the name of the conference the "Learning Aspects" are highlighted.

On behalf of ISME I welcome the participants and wish them a fruitful experience during the conference. I once again applaud the efforts of the organizing committee of the FLAME-2018 for setting up this event for our professional upliftment.

PLENARY TALKS

PLENARY TALK 1

TECHNOLOGY DEVELOPMENT FOR EXTRACTION OF METHANE FROM UNCONVENTIONAL HYDROCARBON RESOURCES

Prof. (Dr.) K. Muralidhar
Professor, Department of Mechanical Engineering
Indian Institute of Technology Kanpur, India

ABSTRACT

World-wide, energy generation technologies such as gas turbines and fuel cells have anticipated a migration towards gaseous fuels. A driving force for this trend is the carbon- hydrogen (C:H) ratio, with the hydrogen component progressively increasing with time. In the ultimate analysis, it suggests a migration towards hydrogen. In the interim, the search for viable hydrocarbons continues since their combustion and utilization characteristics are fully understood. Gas reservoirs of limited significance have been found within the country, for example coal bed methane and shale gas. Additionally, the prospect of obtaining gas in the long run, from gas hydrate reservoirs may become a reality. Such reservoirs have an added potential of storing large quantities of CO2 in hydrate form. Consequently, technologies from extraction of gas from gas hydrates, energy conversion to an appropriate form all the way to exhaust gas disposal need to be developed in the local context. Gas hydrates refer to a class of solid crystalline compounds where guest gas molecules are caged in a solid ice lattice. Among commonly occurring gas hydrates, methane hydrate, present in the marine sediments, is now identified as a potential source of hydrocarbon fuel. The global storage of methane in the hydrate form exceeds all other known hydrocarbon reserves. The extraction of methane from marine sediments however, poses multiple challenges and opportunities to the practicing engineer. Safe extraction processes that keep the fragile marine-ecosystem unaltered require significant infrastructural investment. On the other hand, methane extraction from the gas hydrate provides an option for CO2 sequestration. Furthermore, controlled extraction impedes the possibility of accidental release of methane due to global warming. Uncontrolled release of methane, a potent greenhouse gas, may seriously endanger the global ecosystem. It is, therefore, imperative to identify possible technologies for methane extraction from marine sediments. Among the possible techniques, depressurization, and injection have been identified as the two most promising ways for extracting methane from the gas hydrate stored in the marine sediments. Depressurization requires destabilizing the chemical structure of the gas hydrate by lowering the pressure below the thermodynamic limit. Since the gas hydrate is stable only at high pressure and below ambient temperature, depressurization seems to be a suitable approach for methane extraction. Such a process also guarantees controlled release of methane by precisely adjusting the extraction pressure. Contrary to depressurization, the injection processes attempt to replace the methane, engaged in the hydrate-lattice, with another suitable gas. Both processes have their advantages and disadvantages. While depressurization facilitates rapid release of CH4, the process may weaken the hydrate-bearing structure.

Injection, on the other hand, ensures structural stability at the expense of being slow and energy-intensive. Additionally, the injecting gas needs to be non-corrosive in natureand should have lower free energy than methane at the hydrate-formation environment. In this respect, nitrogen injection to sweep free gaseous methane, dissociate gas hydrates, thermally manage the reservoir, and provide structural stability is a powerful option. Exploration of gas hydrates was initiated by the Gas Authority of India Limited of the Ministry of Petroleum & Natural Gas. The National Gas Hydrate Program (NGHP) created under the Directorate General of Hydrocarbons (DGH) has participation from public sector organizations such as ONGC, OIL, and GAIL, and CSIR laboratories such as NGRI and NIO. Their studies have established the presence of gas hydrates under the ocean bed of the Indian peninsula. Significant amount of free gas has been detected below the hydrate-rich formation. The estimated quantity is large enough to support the energy security of the country for the next 200 years. Gas hydrates reserves have been located at the Krishna–Godavari, Mahanadi, Andaman, Kerala–Konkan, and Saurashtra regions at water depths of 500 to 2500 m. The next task of environmentally benign technology development for gas recovery is underway. Technology development for the utilization of gas hydrates, essentially a methane source, calls for an intensive, yet coordinated and multi-disciplinary research, along with an understanding of natural phenomena on one hand, and development and design of engineering systems on the other. Issues to be addressed include physico-chemical hydrodynamics of flow of methane in natural formations, energy exchanges with the host rock, chemical reactions and changes in the structural integrity of the host formation. The gas thus recovered from the site can be liquefied and transported to conventional gas turbine installations for power generation. Alternatively, power can be generated at the site using newer technologies. Many of these decisions will depend on economic factors prevailing at the time, but the need to anticipate all possible scenarios cannot be over-emphasized. A mathematical model of multi-species multi-phase transport in a porous reservoir, based on principles of conservation of mass, momentum and energy has been developed. The model equations are numerically solved to simulate flow and heat transfer in the hydrate reservoir, bounded by a depressurization and an injection well. The model, validated on a laboratory scale, remains to be tested under field-scale conditions.

BIO-SKETCH

Dr. K. Muralidhar is Professor of Mechanical Engineering at Indian Institute of Technology Kanpur (India) since 1995. He has a Ph.D from University of Delaware (1985) and has postdoctoral experience at Lawrence Berkeley Laboratory, USA.

Dr. Muralidhar has conducted a wide range of experiments and performed numerical simulation in subjects related to fluid mechanics and heat transfer. Over a hundred and fifty publications arising from this research have been published in well-known international journals. He has also authored two text books and six monographs. He has developed optical measurement techniques and numerical algorithms in the area of fluid and thermal sciences. His work has led to better understanding of transport phenomena in porous media, wake dynamics, flow control, crystal growth, and biomedical flows. Dr. Muralidhar's research finds applications in gas hydrates, regenerators, growth of optical crystals and vapor-liquid phase change phenomenon. He was among the earliest to apply a thermal non-equilibrium model for performance evaluation of regenerators in cryocoolers. His work on interferometric tomography, fluid-fluid interfaces and schlieren imaging of convection patterns around growing crystals is well-recognized and have appeared as invited review articles. He has a filed international patent related to enriching coarse MRI images of blood flow, and four filed Indian patents on (i) peristaltic pump for time-dependent flow rates and (ii) imaging chaotic flow in enlarged arteries, (iii) enhanced solar stills, (iv) optical determination of thermal diffusivity, and one on (v) wall heat flux sensor using a single thermocouple sensor.

Dr. Muralidhar has developed algorithms for numerical simulation of multi-phase flow in porous media, oscillatory flows, and inverse techniques for optical imaging and wall heat flux measurement. His work shows that three-dimensional vortex interactions in nominally two-dimensional geometries can be used for flow control.

In his tenure as **Head,** Department of Mechanical Engineering, Dr Muralidhar was successful in increasing the number of students in the doctoral program. A large number of new faculty joined the Department and major funding for equipment was secured from various agencies. He brought focus on micro-engineering – mechanics, transport, imaging, and manufacturing, within the Department. As **Dean, Research and Development,** he consolidated groups on solar energy, advanced mechanics, and high-performance computing, apart from streamlining operations related to research management. The Institute saw a substantial growth in project funding during this period. Dr Muralidhar created research outlets for undergraduate students, resulting in activities such as an autonomous vehicle and a lunar rover, a popular publication called NERD, and an informal group called POWER dedicated to solving industry-oriented problems.

He has coordinated a national initiative on solar hydrogen generation, a multi-institutional project on CFD code development on unstructured grids, and an initiative on futuristic mechanics. He is presently engaged in research related to gas hydrates and vapor-liquid interfacial phenomena including condensation over textured surfaces. He is the immediate past-President, National Society of Fluid Mechanics and Fluid Power (India). He is a Fellow of Indian National Academy of Engineering as well as a Fellow of National Academy of Sciences.

PLENARY TALK 2

TRIBOLOGY AND SURFACE ENGINEERING: FROM NANOSCALE PHENOMENA TO INDUSTRIAL APPLICATIONS

Prof. (Dr.) Sriram Sundararajan
Professor of Mechanical and Industrial Engineering,
Associate Dean for Academic Affairs, College of Engineering
Iowa State University USA

ABSTRACT

Tribology is the science and engineering of interacting surfaces in relative motion. It includes the study and application of the principles of friction, lubrication and wear. This long-standing field impacts a large range of application areas ranging from biomedical implants to wind turbines. This talk will highlight two experimental studies conducted by Dr. Sundararajan's group that explore interfacial phenomena at different length scales. The first will address the characterization of nanoscale wear phenomena and highlight the use of 3D atom probe tomography (APT) in helping to characterize fundamental wear mechanisms associated with a sliding contact between a scanning probe tip and a metal surface. First, the use of ATP to successfully characterize the apex of a scanning probe tip will be described. Next, a study that utilized scanning probe microscopy and molecular dynamics simulation to investigate the nanoscale wear of a silicon dioxide tip sliding on a copper substrate will be detailed. Wear was characterized in terms of structural and chemical evolution of the system where the latter is possible experimentally using APT of the slid tips. Comparison of the experimentally-observed and simulation-predicted wear revealed that adhesive wear is dominant in the short sliding distances of the simulation at any applied load, while the sliding distances in the experiments are long enough to observe load-induced transitions between adhesive dominated and abrasive dominated wear. The second part of the talk will address efforts to understand the interfacial phenomena in rolling-sliding contacts subject to high contact pressure and low operating speeds, such as those encountered in drive-trains in agricultural equipment and wind turbines. Specifically, the effect of retained austenite on the micro-pitting behavior of AISI 8620 steel will be discussed. Samples with RA ranging from approximately 0 to 70% were prepared using specific carburizing schemes. Rolling contact fatigue tests were carried out at maximum contact pressure 1.5 GPa using a benchtop test rig. Samples were subsequently analyzed using noncontact white light profilometry and micro X-Ray Diffraction to observe the evolution of micro pitting and RA respectively. An increase in RA% resulted in increased micropitting life. The failure mechanism for the lowest RA samples was dominated by early crack initiation and rapid crack propagation, whereas samples with medium and high RA showed initiation and propagation of micropitting with clear evidence of RA transforming to martensite. Higher levels of RA% to ensure a stable amount remains after this transformation is desirable for extended micro pitting life. An extended finite element method (XFEM) which included a Voronoi tessellation to randomly generate the steel microstructure was used to simulate the experiments, and showed that consistent with experimental

findings, crack propagation was increasingly hindered in the case of microstructure with increasing RA%. Testing was also conducted using nanofluids consisting of 1% of tungsten carbide (WC) and copper oxide (CuO) nanoparticles by weight and 1% by weight of oleic acid surfactant in Polyalphaolefin (PAO). Both the nanofluids exhibited increased micro pitting life compared to the base oil. Tungsten carbide nanofluids showed significantly higher micro pitting resistance behavior than the copper oxide nanofluids under the boundary lubrication regime. Analysis of the surfaces showed different mechanisms to inhibit micro pitting and wear for the two nanofluids-the tungsten carbide nanofluid formed a tribo-film whereas the CuO nanofluids tended to fill surface cracks with the nanoparticles.

BIO-SKETCH

Dr. Sriram Sundararajan is a Professor of Mechanical Engineering at Iowa State University and serves as the Associate Dean for Academic Affairs in the College of Engineering. His research areas encompass multiscale tribology (friction, lubrication and wear) and engineering education. He has authored over 100 articles in peer-reviewed journals and conference proceedings. Dr. Sundararajan is Fellow of the American Society of Mechanical Engineers (ASME) and serves the society as an ABET program evaluator and on their Diversity and Inclusion Strategic Committee. He is an executive committee member of the Mechanical Engineering Division of the American Society of Engineering Education (ASEE). He is also a steering committee member for the International Conference on Wear of Materials. Dr. Sundararajan received his B.E. degree in Mechanical Engineering from The Birla Institute of Technology and Science, Pilani (India) followed by M.S. and PhD degrees in Mechanical Engineering from The Ohio State University, Columbus, Ohio.

PLENARY TALK 3

OPTICAL ENGINEERING – ANEW DISCIPLINE FOR MECHANICAL ENGINEERS

Prof. (Dr.) Anand Asundi
Professor, School of Mechanical and Aerospace Engineering,
Nanyang Technological University, Singapore
Founder-Director, d'Optron Pte Ltd.

ABSTRACT

Optical engineering is a new discipline which has evolved rapidly this century to harness the science of optics and the technology of photonics. With applications ranging from 3D imaging and 3D printing to x-ray CT scanners, there is virtually no sector untouched by this technology. Companies such as Google and Apple to Zeiss and Nikon to Alcatel-Lucent to Coherent and others are actively pursuing the capabilities on offer. So where do mechanical engineers fit into this scheme. Mechanical Engineers have strengths in design, manufacture and assembly and inspection and testing of instruments and systems. Hence with the proper training, we are at the forefront on optical lens and camera design and manufacture, assembly of microscopes and optical systems and testing and quality control of MEMS and nano-devices. In this talk, I will take you through my journey through this exciting field overcoming administrative obstacles and challenges along the way. I will also highlight my current endeavors in this field as my focus moves from research to innovation to commercialization. Briefly my current research focus areas can be classed under – Photomechanics, Computational Imaging and Metrology and Optics for Life. In Photomechanics (Light to solve problems in mechanics), I will highlight the Polariscope – an instrument used to measure residual stress in injection molded plastics as well as stress concentration factor at various notch tips. Polariscopes are also widely used commercially in Gemology. Computational Imaging has taken photography to a new level. In this, I will describe the Holoscope which is a lensless 3D imaging system with applications in MEMS and Microsystems Metrology. Commercial counterpart of this is the Light Field Camera, albeit based on a different principle which unlike normal cameras takes a picture first and focuses on any part of the image later. Finally Optics for Life is a relatively new concept for me. From a research perspective, we have developed a Biomager camera which can easily convert your existing microscope into a live 3D measuring instrument. Applications of this abound in bioimaging as well as industrial imaging. From a more layman perspective, the sun has been the source of not only light for reading but more importantly light for health. This is something we have lost as we are caged in our offices and homes for a large part of our daily life. With advances in lighting technology, it is now possible to achieve similar benefits of the outdoors, indoors as well. Plants have taken advantage of this by growing in vertical farms in space limited or cold countries such as Singapore and Europe. Most of these systems described above are available from d'Optron Pte Ltd. (www.doptron.com) In addition, education becomes vital and to attract students from

a young age to get into this growing field has also been my focus. Towards this end, I have developed an OpticsKit which aims to make entry into this field exciting and fun regardless of your background and interest. Unlike traditional kits which showcase basic principles, the current kit introduces students to optical systems. This allows them to interact with the system and gets them excited with the technologies and explore applications regardless of their interests. As they progress, through their studies, the same kit can be exploited for explaining science as well as developing application. The three systems are – OptoSens, Optobot and OptoVR/AR. OptoSens uses the new RGB-D cameras which apart from getting color images also provides depth information of objects in real time. One of the current applications of this concept is the in the driverless cars.The second system is the Optobot. As the name suggests this uses a novel color sensing camera to be incorporated into robots. Of course, color sensing has other applications and one of them involves checking for ripeness of bananas. The final system, OptoVR/AR introduces use of optics in Virtual and Augmented Reality systems. Novel applications can be developed to not only see in 3D but interact with 3D scenes.

BIO-SKETCH

Dr. Anand Asundi graduated with B.Tech and M.Tech from IIT-Bombay and then got his Ph.D from Stony Brook University. He is currently Professor and Director of the Centre for Optical and Laser Engineering in the School of Mechanical and Aerospace Engineering at the Nanyang Technological University in Singapore. He has over 500 publications and presented talks at numerous conferences and organizations. He was a High-End Foreign Expert at Shanghai University for the past three years. He is founder of d'Optron Pte Ltd., Editor of Optics and Lasers in Engineering (IF=3.3) and Fellow of SPIE and Institution of Engineers, Singapore. He is founding chair of the Optics and Photonics Society of Singapore and founding Chairman of the icOPEN conference series.

KEYNOTE TALKS

KEYNOTE TALK 1

RESEARCH PROBLEMS IN MODAL PARTICIPATION ANALYSIS OF DYNAMIC SYSTEMS

Prof. (Dr.) Eyad H. Abed

Professor, Department of Electrical and Computer Engineering and the Institute for Systems Research
University of Maryland, College Park, MD USA
E-mail: abed@isr.umd.edu

ABSTRACT

Selective Modal Analysis (SMA) is a technique based on quantification of the relative contributions of system modes on system states, and of system states on system modes. The technique has been used in diverse applications, such as electric power grid dynamics, mechanical vibrations, and econometrics. SMA has been used in these fields for goals such as model order reduction that retains only a set of desired modes, and actuator and sensor placement. This talk will give an analytical overview of SMA and will present recent developments in a re-examination of the fundamental principles, along with suggested promising future research directions. The importance of obtaining tools and results that are independent of chosen units of measure of the system state variables will be emphasized, and mathematical aspects related to this issue will be brought to light. Both linear and nonlinear models will be considered, in a general framework of autonomous systems governed by systems of ordinary differential equations. Connections with detection of impending instability of uncertain nonlinear systems will also be presented, along with research issues in determining precursors for instability that have not been given deep consideration in the existing literature

BIO-SKETCH

Dr. Eyad H. Abed is a Professor of Electrical and Computer Engineering at the University of Maryland, College Park, where he is also affiliated with the Institute for Systems Research. During 2014-2017, he was on an intergovernmental appointment as a Program Director in the Energy, Power, Control and Networks (EPCN) Program within the Division of Electrical, Communications and Cyber Systems (ECCS) of the U.S. National Science Foundation. During 2002-2008, he served as Director of the Institute for Systems Research at the University of Maryland. During 2009-2012, he served as Dean of the College of Information Technology at the United Arab Emirates University.Dr. Abed received the S.B. degree from the Massachusetts Institute of Technology in 1979, and the M.S. and Ph.D. degrees in 1981 and 1982, respectively, from the University of California at Berkeley, all in Electrical Engineering. He is a Fellow of the IEEE, and a recipient of several awards, including the Presidential Young Investigator Award from the National Science Foundation, the O. Hugo Schuck Best Paper award from the American Automatic Control Council, a Senior Fulbright Scholar Award from the Council for the International Exchange of Scholars, the Outstanding Systems Engineering Faculty Award of the Institute for Systems Research, the Alan Berman Research Publication Award from the Naval Research Laboratory, and two teaching awards from the University of Maryland. He has been on the editorial boards of the IEEE Transactions on Automatic Control and the journal Nonlinear Dynamics. He was also a member of the Executive Committee of the IEEE Control Systems Society and served as its Vice President for Financial Activities during 2007-2009. He has consulted for several corporations and government agencies in the application of control and dynamic modeling to problems in energy, radar and aircraft engine dynamics.

KEYNOTE TALK 2

MULTISCALE SIMULATION STUDY OF DEFECTS IN ELECTRONIC DEVICES UNDER RADIATION ENVIRONMENT

Prof. (Dr.) Eugene Pak

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ABSTRACT

With the recent resurgence of space programs spearheaded by commercial companies such as SpaceX and Blue Origin, a new era of space age is dawning. This brings attention to spaceborne electronic systems that must withstand the harsh space environment. GaN-based electronic devices are very attractive for space applications since their radiation hardness characteristics are superior to the Si-based devices. For space missions requiring very conservative design margins, the presence of fabrication-induced defects as well as the radiation-induced defects limit the utilization of space-borne electronic devices. Therefore, prediction models to understand the defect generation mechanisms and the radiation effects on GaN devices are needed to properly engineer the reliability of these devices for the radiation environment

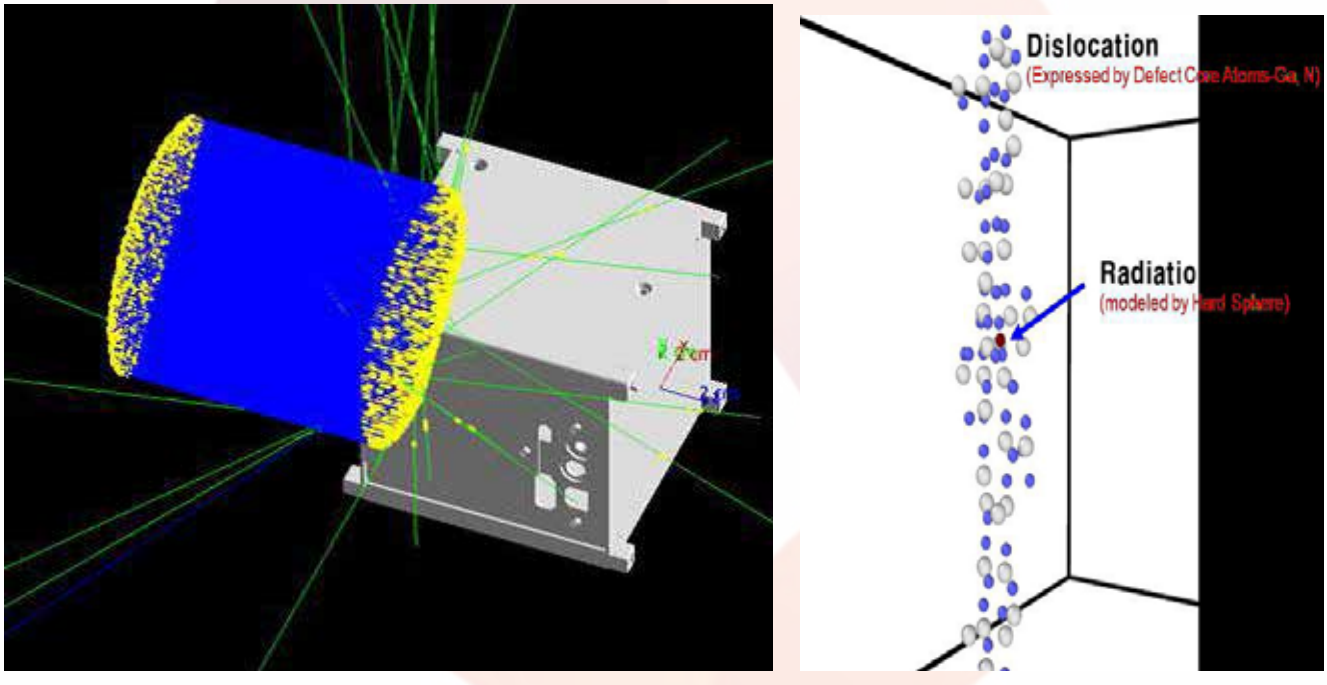

Figure 1. (a) Monte-Carlo simulation of proton-irradiated CubeSat (GEANT4) and (b) Molecular dynamics simulation of interaction between threading dislocation and radiation particle (LAMMPS).

To this end, we developed the quantitative linear elasticity models that can predict the stresses and piezoelectric fields induced in multilayer quantum wells in the presence of point defects and dislocations. These electro elastic field calculations are coupled with the quantum mechanical formulation to predict the electronic and optical behavior of GaN-based devices such as LEDs and high-electronic-mobility transistors (HEMTs). To characterize the radiation effects, molecular dynamics (MD) simulations were performed to study the formation mechanisms of point defects caused by the energy transfer from irradiated particles. The required parameters for MD simulations were obtained by the Monte Carlo (MC) simulation code, GEANT4, and the results are compared with the irradiation test results.

BIO-SKETCH

Dr. Y. Eugene Pak currently working with Advanced Institutes of Convergence Technology, Seoul National University. Dr. Y. Eugene Pak did Ph.D in Mechanical Engineering in 1982 – 1988 from Stanford University, followed M.S., Mechanical Engineering in 1980 – 1982 & B.S., Mechanical Engineeringin 1976 – 1980 from Stanford University and SUNY at Buffalo. Dr. Y. Eugene Pak has worked as the Vice-President at Samsung Electronics for more than a decade and also was the Research Associate Professor at SUNY at Stony Brook for a year and before that Dr. Y. Eugene Pak was the Senior Research Scientist at Grumman Aerospace for nearly a Decade.

KEYNOTE TALK 3

MANUFACTURING: VISION FOR FUTURE

Prof. (Dr.) V. K. Jain
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ABSTRACT

This talk basically deals with the following issues: Be keen observer, Introductionto manufacturing as vision for future, two major issues of futuristic manufacturing,ntroduction to micromanufacturing, micromachining, additive manufacturing,nano-finishing and some applications of micromanufacturing.It deals with two important issues of futuristic manufacturing namely,micromanufacturing and green manufacturing. These two issues seem to becontradictory to each other from green manufacturing point of view.In the present day world, one cannot live without miniaturization in every field ofeveryday life starting from kitchen to the offices, industries and personal life,taking the example of mobile phone which encompasses phone, computer,internet, books and what not. When we want to talk about the futuristic manufacturing, we cannot ignore"additive manufacturing" which is going to replace many traditional and advancedmanufacturing processes which are not environment friendly and sometimeseven hazardous to the health of the operators and the surrounding machinetools. Additive manufacturing, also known as 3-D printing technology is playing leadingrole in the biomedical, automobile as well as space technology. Aerospaceindustries, namely GE is spending millions and millions of dollars on R & D tomake an aero plane engine lighter by 1000 ponds as compared to the presentone.Replacement and repairing of the human implants is the need of the day. 3-Dprinting is playing a major role in this area. Some examples are included in thetalk related human implants.When one talks of micromanufacturing, one cannot ignore nano-finishing of theparts without which these parts cannot function as desired by the designer.

Nano and sub-nano level surface finish is the basic requirement in many microand nano sized components. It is a challenging task to achieve surfaceroughness value which is as good as the size of an atom.Finishing of 3-D components, complex shaped components and freeformsurfaces pose many challenges in real life. How to solve such kinds of real lifeproblems and what are the different types of solutions available will be discussedin brief. Lastly, a couple of slides will introduce the importance of hydrophobic and super-hydrophobic surfaces and how to generate such surfaces on metals and non-metals so that today's industries can make use of such techniques to producethe components / products for the benefit of military, aerospace industries, common man etc.

BIO-SKETCH

Dr. Vijay K. Jain passed his B. E. (Mechanical) from Vikram University Ujjain in 1970, and M. E. (Production) from University of Roorkee in the year 1973. He did his Ph.D. from University of Roorkee in Mechanical Engineering in the year 1980. He has forty years of teaching and research experience. He has served as a Visiting Professor at the University of California at Berkeley (USA) and University of Nebraska at Lincoln (USA). Presently he is a Professor at Indian Institute of Technology Kanpur (India). He has also served as a faculty at other Indian institutions, namely, M. R. Engineering College Jaipur, B. I. T. S. Pilani, and M. N. R. Engineering College Allahabad.

KEYNOTE TALK 4

MICRO PATTERNING OF LARGE SURFACE AREA USING MULTIPLE ELECTRODES IN MICRO ELECTROCHEMICAL MACHINING PROCESS

Prof. J. Ramkumar
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ABSTRACT

Electrochemical machining has gained significant attention from researchers around the globe owing to the advantage such as absence of heat affected zone, thermal and residual stresses, recast layer, generation of a burr-free surface, relatively low setup and operation cost, ability to machine very hard and non-uniform work piece surfaces with amorphous crystal structure and zero tool wear rate as compared to any other process both in the domain of conventional/non-conventional machining processes. In ECM, the material is removed by electrochemical dissolution at the atomic level, and hence, the very fine surface finish of machined surface can be achieved. As there is no physical contact between tool and workpiece surface and tool has theoretically infinite life, there is no restriction on the minimum dimension of tool that can be used, making this process most suitable for micromachining. The process of surface texturing finds application in biomedical industry to generate micro textures on surgical implants to impart desired tribological characteristics, in the aerospace industry, the process can be used to generate textures on large surface areas of wings of an aircraft which aids in reducing air drag. Using a single point tool for surface patterning associate several disadvantages with it. Due to low production rate, the process is not suitable for texturing on large surface areas. Also, as the distance between two consecutive features machined on the surface is in few micrometres, there is a recursive problem of dissolution of preceding feature and textures become blunt. In the present work, an attempt is made to investigate the role of using multiple tools for micromachining patterns on the large surface area. An indigenously developed experimental setup along with the pulsed power supply is used for carrying out experiments to generate different patterns on various surfaces. High pulse frequency of 60 kHz is used in the experiments to obtain localized dissolution and continuity in the machining patterns. By using a common power input for all the electrodes, the charging time of double layer around each electrode increases and pulse shape gets distorted. This also increases peak power requirement. To overcome the problems mentioned above, a novel approach is used in developing a method of sequential firing between the electrodes. Initially, different micro tools were fabricated on the setup with diameters ranging from 25 µm to 90 µm using electrochemical etching by carefully controlling the input current and machining time. To establish the applicability of the developed process, micro hole arrays were fabricated on SS316L with holes of diameter 120-300 µm and minimum pitch of 200 µm. By using a fixed firing sequence, micro channels of width 70 µm and protrusion length of 35 µm were achieved using a tool of the diameter of 25 µm. After identifying the optimum values of different process parameters, various surface patterns like sharklets, riblets, and chevrons were generated. In the final part of this work, the effectiveness of these micro features was established by simulating the dynamics of fluid flow over textured surfaces in COMSOL Multiphysics 5.2 software. Results suggest a significant reduction in drag force (30%) experienced by a body with the textured surface as compared to the one with a smooth surface. A wettability test is conducted, and a contact angle of 119.70 between the droplet and textured surface as compared to 74^{o} on a flat surface is obtained which signify that a decent degree of hydrophobicity is induced on the workpiece.

BIO-SKETCH

Dr. J. Ramkumar is a Professor, Department of Mechanical Engineering at Indian Institute of Technology, Kanpur. He completed his PhD from IIT Madras in 2003 and M. Tech from IIT Madras in 2000.His areas of expertise are manufacturing processes and computer aided manufacturing. Dr. J.Ramkumar has also been facilitated with auspicious awards like Gold medallist in M. Tech, IIT Madras, 2000, Innovation Potential of Student Projects Awards - Indian National Academy of Engineering (INAE), 2004, Young Scientist Award- Engineering Science Division- Indian Science Congress Association, 2007, Young Scientist Award - Dept. of Atomic Energy, India, 2007, Rajkumar Varshney Awards - System Society of India, 2010.

KEYNOTE TALK 5

CFD DEVELOPMENT AND ANALYSIS – A PHYSICAL AND INSIGHTFUL APPROACH

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ABSTRACT

Computational Fluid Dynamics (CFD) is a theoretical method of scientific and engineering investigation, concerned with the development and application of a video camera like tool (a software) which is used for a unified cause-and-effect based analysis of a fluid-dynamics as well as heat-and-mass-transfer problem [1]. Here, a physical approach to CFD development (algebraic-formulation and solution-methodology) and an insightful approach to CFD analysis is presented - can be found in a recent text-book by Sharma [1].

Development of any computational methodology for simulation of a physical phenomenon depends on associated physics, which is modeled mathematically – physics gives the purpose and maths provides the appropriate tools for the development. The resulting physics based simulation software involves numerical solution of governing equations (for a computational method) – system of Linear-Algebraic-Equations (LAEs). The governing LAEs are derived from continuous-mathematics based partial-differential-equations (PDEs), using mostly Finite-Element-Method (FEM) in computational solid mechanics and Finite-Volume-Method (FVM) in CFD. The FVM based algebraic-formulation in CFD involves application of volume integral and Gauss-divergence theorem to the governing PDEs (continuity, momentum, and energy equations) – the PDEs based FVM results in a mathematical approach of FVM. Here, a more physical approach of FVM is presented for the algebraic-formulation in CFD – application of discrete-mathematics (PDE free) to a discrete-form of mass, momentum, and energy conservation laws [1]. Statements for application of these physical laws to an elemental control-volume (CV) are presented in two different forms: continuous and discrete. Application of continuous-mathematics to the continuous-form leads to a differential-formulation (in fluid-dynamics and heat-transfer) while application of discrete-mathematics to the discrete-form leads to an algebraic-formulation (in CFD) – a physical approach of FVM (discrete-form of physical law and discrete- mathematics based FVM). The objective is to demonstrate that the algebraic-formulation is any computational course should involve discrete (independent of continuous) mathematics – proposed for a CFD course by Sharma [1]. Around the same time, similar but more general idea of differential formulation free algebraic-formulation was proposed by Tonti [2]. He emphasized that this algebraic formulation avoids any arbitrary process of discretization of differential equations; and has great merit of maintaining close between the mathematical description and the physical phenomenon described. Since the advent of computer, there is an enormous development in the discrete mathematics; however, if we change our habits of considering the differential/continuous formulation as indispensable and work on the discrete independent of the continuous mathematics, it will lead to an increase as well as enrichment in the range of applications [3]. The physical law based FVM provides a more convenient tool for mathematical description of physics of heat and fluid flow.

During the application of mass, momentum, and energy conservation laws to a CV (in fluid-dynamics and heat transfer), the associated variables are of two-types: flux and volumetric, depending on the surface-area

and volume of the CV, respectively. The flux terms are mass-flux $\vec{m}$, momentum-flux $\vec{m}\vec{u}$, viscous-stress σ, pressure *p,* enthalpy-flux $\vec{h}$, and conduction-flux $\vec{q}$; and the volumetric terms are volumetric-mass *ρ,* volumetric-momentum $\rho\vec{u}$, volumetric-enthalpy $\rho c_p T$, volumetric-heat-generation, $\overline{Q}_{gen}$ Note that the flux-terms are I-order (vectors) and II-order tensors for scalar (mass and energy) and vector (momentum) conservation laws, respectively; and the volumetric terms for the respective laws are 0^{th}-order (scalar) and I-order tensors. However, since the momentum conservation laws are applied component wise, the associated I-order volumetric and II-order flux terms gets converted to 0^{th}-order and I-order tensors, respectively

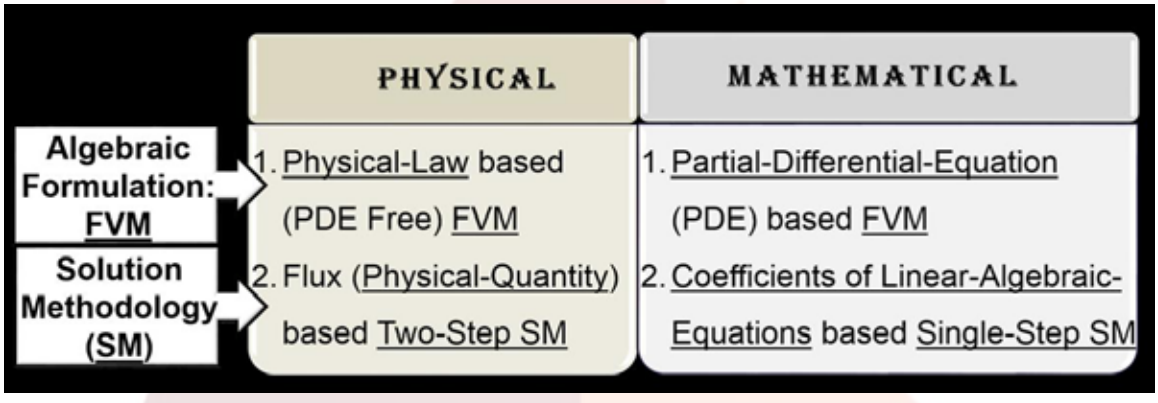

Fig. 1: Physical and mathematical approach of CFD development [1].

Along with the physical-law based FVM, Fig. 1 shows that the physical approach for CFD development consist of flux (physical quantity) based solution methodology. For unsteady heat conduction, the methodology involves computation of conduction heat-flux in the first-step and temperature in the second-step. For unsteady fluid dynamics and heat transfer, various flux-terms (mass-flux, momentum-flux, enthalpy-flux, viscous-stress, and pressure) are computed in the first-step and flow-properties (pressure, velocity, and temperature) are computed in the second step. Using two-approximations for the discrete representation of the physical laws [1], the grid-point for the volumetric and flux terms are defined at the centroid of the volume and various-surfaces of the CV, respectively.

CFD as a virtual video camera leads to two types of movies: scientifically exciting and engineering relevant movies. The actors are flow-properties (pressure, velocity, and temperature) in the former and engineering-parameters (lift-force, drag-force, pressure-drop, and heat-transfer-rate) in the latter movies; and the characters in the respective movies are flow phenomenon (such as boundary layer, flow separation, and vortex formation/shedding) and characteristics of variation of engineering parameters. A time wise synchronized generation of scientifically exciting and engineering-relevant movies [4] leads to a scientifically exciting and engineering relevant story of a fluid dynamics problem, called as unified cause-and-effect based analysis [1].

The present physical approach to CFD development will result in a better physical understanding of the algebraic-formulation as well as solution methodology and may lead to more realistic numerical models. It will also enable startups on development of apps (application-software) for various engineering applications. Also, the more insightful and comprehensive approach to CFD analysis – unified cause-and-effect based analysis – of the big-data generated by the software will lead to much better understanding of fluid dynamics problems in nature/industries.

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BIO-SKETCH

Dr. Atul Sharma is currently a Professor in the Department of Mechanical Engineering at IIT Bombay, with a teaching and research experience of more than 15 years. He did his B.E from NIT Raipur (C.G.) in 1990-1994, M.E. from IISc Bangalore in 1996-1998 and Ph.D from IIT Kanpur in 2000-2004. As a faculty, he worked as Lecturer at RIT Raipur from 1995-1996 and at NIT Hamirpur (H.P.) from 1998-2000. Furthermore, he joined IIT Bombay as Assistant Professor in 2004, was Associate Professor from Jan. 2011- March 2015 and is Professor since April 2015. He co-authored a Chapter in Finite Volume Method in a revised edition on an edited book on Computational Fluid Flow and Heat Transfer in 2003. He teaches subjects related to fluid mechanics, heat transfer, computational methods and computational fluid dynamics. He delivered a course on CFD to more than 1200 collage teachers from different parts of INDIA in 2012 - as a part of a project funded by Ministry of HRD under National Mission on Education – as well as through Centre for Distance Engineering Education Programme IIT Bombay from 2007-2010. His primary research specialization is CFD and is currently working on development of level set based numerical methodology for simulation and analysis of multi-phase flow and fluid-structure interaction problems. He is CFD consultant for Global R&D, Crompton Greaves Limited, Mumbai, since 2010. He was financial Secretary from 2011-2014 and Secretary for National Society of Fluid Mechanics and Fluid Power since December 2014. He has more than 45 international journal publications and graduated 7 Ph.D. and 22 MTech. students so far.

KEYNOTE TALK 6

PROGNOSTICSOFHIGH-SPEEDBEARINGSUSINGWEIBULLDISTRIBUTIONANDSIMPLIFIED FUZZY ADAPTIVE RESONANCE THEORY MAP

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Professor
Departmnet of Mechanical and Industrial Engineering, Indian Institute of Technology, Roorkee

ABSTRACT

This talk will present the data-driven prognostic technique with combination of Weibull distribution (WD) and neural network of Simplified Fuzzy Adaptive Resonance Theory Map (SFAM) for estimation of bearing remaining useful life. For training phase, WD is fitted to measured values so that the fluctuation area may be avoided in extracted features of time domain. The fitted features values at previous and present inspection times are applied as input to SFAM network. For testing process of SFAM, an original extracted feature at present and previous inspection times are used. The output of SFAM are classified into eight classes to define complete degradation of bearing and smoothing algorithm prefer for prediction of RUL. The SFAM presents good performance and ability of learning nonlinear time series. Measurement of Bearing Friction Torque The frictional force characteristics between rotating and a stationary component of the bearing are expected to evolve as damage progresses in bearing. The friction torque transducer is accomplished such a behavior of bearing. Here, transducer acquires an information of frictional torque and eliminate the effect of support deformation and lateral loading. The schematic of friction torque measuring system is shown in Fig. 1

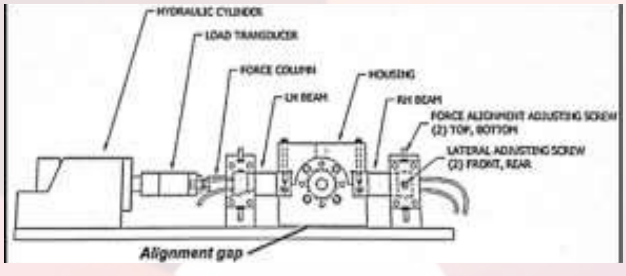

Fig. 1 Schematic of Friction Torque measuring system.

The friction torque measuring system consists of signal conditioner, junction box and two beams (RH Beam and LH Beam). Two different stiffness sets of beams are used to adjust the extensive range of experiments. Their transverse and torsional stiffness are 2500 lbs/in, 5700 lbs/in and 72.8e3 lb- /radian, 166e3 lb-in/radian, respectively. Estimation of Reaming Useful Life (RUL) Estimation of an accurate RUL is aims of proposed SFAM neural network. The following points are as follows. The output of SFAM neural network is proposed to classified in percentage of failure in components i.e. 0% to 100% failure as shown in Fig. 2. The failure threshold is not defined. It has seen that much practical application is very hard to define clearly. The proposed SFAM network is considered that the component is failed at 100%life percentage. The classes of 1 to 8 is presenting a degradation of bearing in terms of failures

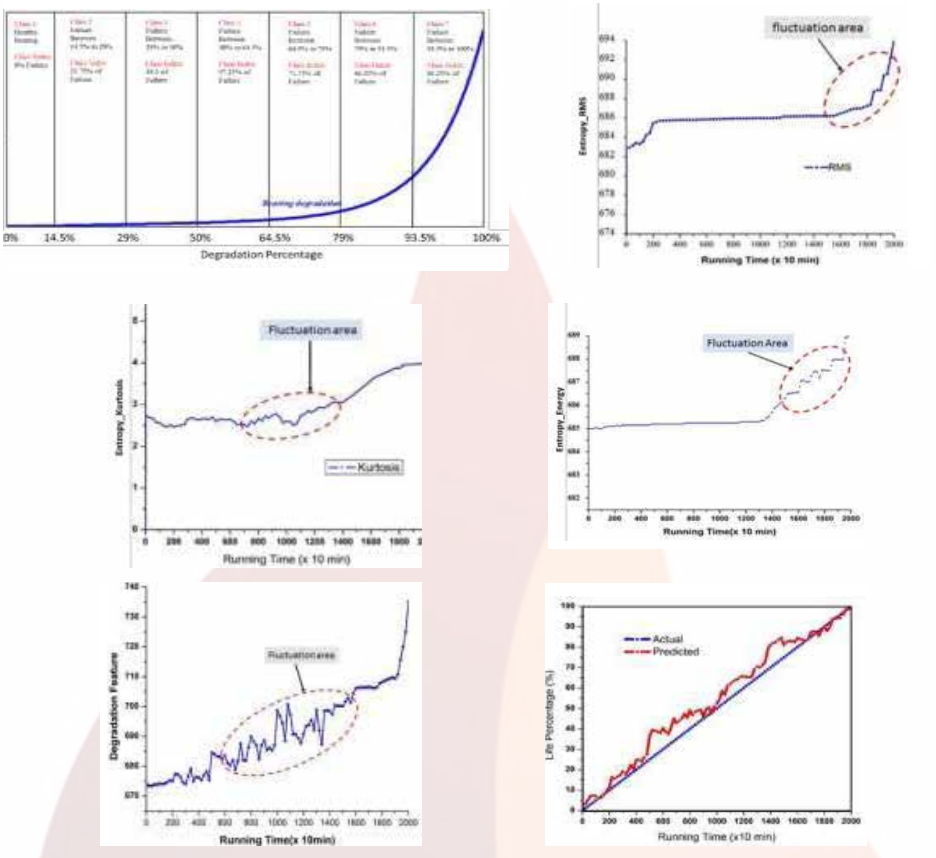

Fig. 3 Feature extracted for Bearing 2 test #2 (a) EntropyRMS (b) Entropy Kurtosis (c) Entropy Energy (d)Degradation

BIO-SKETCH

Dr. S. P. Harsha is an Associate Professor, in the Department of Mechanical & Industrial Engineering at Indian Institute of Technology, Roorkee. His profound areas of teaching & interest are Vibrations & Control, Fault Diagnosis and Prognosis of High-Speed Machinery, CNT based Mass Sensors, Human Vibration, Rail Vehicle Dynamics, Dynamics of FGM Plats/Membrane Structures. Dr. S. P. Harsha did his BE (Mechanical Engineering) from M. B. M. Engineering College, J. N. V. U., Jodhpur in 1996. Dr. S. P. Harsha completed his ME (Mechanical Engineering) from M. B. M. Engineering College, J. N. V. U., Jodhpur in the year 2004, Ph.D (Nonlinear Dynamics & Control) from Mechanical Engineering Department at Birla Institute of Technology and Science, Pilani & Postdoc Fellow under US Defense Project (ONR) at Villanova University, Philadelphia, USA, in 2006-07. In his, acknowledged career he has been awarded for best Paper Awards in ASME-2012 IDETC/CIE, August 2012, CHICAGO, ILLINOIS, USA, best Poster Paper Presentation Award in ICIT, 2008, New Delhi, best Paper Award at Nonlinear Dynamics and Chaos in International Symposium on Nonlinear Dynamics held in Shanghai, CHINA, 2005. Also, he is currently heading numerous projects which are funded by y BHEL, RDSO, THDC, ISGEC, etc.

KEYNOTE TALK 7

OPTIMIZATION AND KNOWLEDGE EXTRACTION OF PLATE-FIN HEAT SINK USING MULTI-OBJECTIVE EVOLUTIONARY ALGORITHMS

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ABSTRACT

The reliability of any electronic component depends on its cooling ability. Heat sinks are generally integrated into electronic devices that cool by blowing-out the heat. The optimization of heat sinks plays a meaningful role in the efficient resource utilization for a given cooling objective. The design problem in the present study has been re-approached simultaneously by using both first and second law of thermodynamics. The present study uses the concept of entropy generation which quantifies the loss of available energy (i.e. exergy). The principle of minimum entropy generation rate produces heat sink designs which are not only thermodynamically efficient but also have better geometric and topological features. This study proposes a multi-objective optimization approach of plate-fin heat sinks that are used as a cooling mechanism in electronic devices. The different variables of the optimization study are number of fins, height of the fin, spacing between the fins, and incoming air velocity. In addition to the restrictions on lower and upper bound of the design variables, there are also few non-linear constraints from geometrical dependency, design specifications, and functional requirements. Two configurations such as heat sink with a flow-through air cooling system and heat sink with an impingement-flow air cooling system are considered in the present work. The plate-fin heat sinks with impingement flow are used to obtain high local and area averaged heat transfer coefficients in the convective heat transfer process. Therefore, this configuration is used where heat flux density is significantly high, like cooling of turbine blades. The plate-fin heat sink with flow through configuration is used when the constraint on the space availability is relatively relaxed. The pumping loss factor also acts as an important factor in selection of plate-fin configuration. The conflicting objectives of multi-objective optimization are entropy generation rate and cost. Minimum entropy generation rate will ensure better cooling. However, the solutions might not be economical. The minimum cost will ensure a design that works better from economic point of view. A multi-objective evolutionary algorithm is applied to solve the optimization problem due to the existence of non-linear constraints and objective functions. NSGA-II is used due to its potentiality to deal with non-linear constraints and objective functions in multi-objective optimization problems. NSGA-II has successfully generated well-spread non-dominated solutions. The non-dominated solutions of a heat sink with a flow-through air cooling system are compared with the results obtained by a multi-objective real-coded genetic algorithm using a direction-based crossover operator by one of the previous studies and it is shown that NSGA-II results outperform the other method. The non-dominated solutions of both cases are analyzed to obtain the interrelationship that may exist among the variables and objective functions. The knowledge extraction results showed that the relationship is simpler in the case of the heat sink with an impingement-flow air cooling system as compared to the heat sink with a flow-through air cooling system. These relationships can provide a deep insight to the users and designers. The present study took into consideration four variables in the optimization study. A generalized plate-fin heat sink can be designed with more variables. Another direction of research could be to increase the number of

constraints and objective functions and solve both configurations as many objective optimization problems. A generalized formulation for the above two configurations can be designed which can assist designers in the development of a plate-fin heat sink used for cooling electronic devices based on their specific needs in terms of cooling rate, space availability, and material cost. The plate-fin heat sinks can also be integrated with smart materials to introduce adaptability in their geometry and performance. This would enable fins to vary their geometry and heat flux rate in response to change in value of thermal parameters of the surrounding cooling medium. The present study can further be used to find the right combination of conventional and smart materials to yield the optimal value of thermal performance, material cost, and operational cost.

BIO-SKETCH

Dr. Rituparna Datta is working as Operations Research Scientist in Boeing Research & Technology (BR&T), BOEING, Bangalore. Prior to that, he was a Post-doctoral researcher with Graduate School of Knowledge Service Engineering, Department of Industrial & Systems Engineering at Korea Advanced Institute of Science and Technology (KAIST), Post-doctoral fellow in French Institute for Research in Computer Science and Automation (Institut national de recherche en informatique et en automatique, INRIA), France, Project scientist in SMSS lab, IIT Kanpur, India and Postdoctoral research fellow with the Robot Intelligence Technology (RIT) Laboratory at KAIST. He earned his Ph.D in Mechanical Engineering at Indian Institute of Technology (IIT) Kanpur in 2013. His current research work involves investigation of efficient algorithm for engineering optimization, evolutionary computation, constrained optimization, multi-objective optimization, surrogate-assisted optimization, memetic algorithms, derivative-free optimization, and knowledge extraction from data, manufacturing and robotics. His research has been published in eight international SCI journals (most of them are in top 20 in the appropriate field, according to google scholar ranking) with few under reviews, two edited books with Springer (one of them is the first book in the Infosys Science Foundation Series), four book chapters, around twenty-five international conferences, and more than ten national conferences. He is a member of ACM, IEEE, and IEEE Computational Intelligence Society. He has been invited to deliver lectures in several institutes and universities across the globe, including at the Trinity College Dublin (TCD), Delft University of Technology (TUDELFT), University of Western Australia (UWA), University of Minho, Portugal, University of Nova de Lisboa, Portugal, University of Coimbra, Portugal, Korea Railroad Research Institute (KRRI), Korea, Korea University and IIT Kanpur.

KEYNOTE TALK 8

AN OVERVIEW OF ENGINEERING SAFETY ISSUES OF POOL TYPE FAST BREEDER REACTORS

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ABSTRACT

The fundamental safety principles applied to a typical Fast Breeder Reactor in order to achieve the overall safety objectives are to compensate for potential human and mechanical failures by a defense in depth approach. In the complementary targets, the containment must be such as to provide sufficient mitigation for postulated Beyond Design Base Events and in the Design Basis Events, faults are analysed with very stringent rules for worst conditions. In spite of all these analyses, complementary provisions are made in order to minimize residual risk based on past experience such as subassembly melt down, sodium fire in a steam generator building, large sodium leak outside the secondary containment etc. A complementary medium line of defence is introduced within the residual risk category to interrupt sequences which would have the potential to cause serious core damage. Different passive or active complementary systems are devised in different ways as per the needs of project. Particular attention has been devoted to decay heat removal in order to provide reasonable assurance of failure prevention. In order to avoid any weak point in the primary containment, the design must present homogenous resistance to energy release in the short term and withstand thermal effects of a core disruptive accident in the long term. The later requires a debris collection tool to ensure retention and long term coolability of whole core inventory via decay heat removal system. In order to mitigate or eliminate the risk of severe accidents, a series of experimental and numerical thermal hydraulic investigations are carried out at Indira Gandhi Centre for Atomic Research. This talk deals with a few key investigations towards robust design of Indian Fast Breeder Reactors.

BIO-SKETCH

Dr. Anil Kumar Sharma is working in Safety Engineering Division, Fast Reactor Technology Group, IGCAR, Kalpakkam. He completed his Ph.D from Indian Institute of Technology (IIT), Tamil Nadu. His research topic includes CFD and heat transfer, Thermal hydraulic analysis of reactor systems, LMFBR safety analysis, Development of computational models and conjugate turbulent natural convection. Dr Anil Kumar Sharma has been awarded with Scientific and Technical Excellence Award-2009, in recognition of outstanding contribution to the departmental program.

KEYNOTE TALK 9

PERSPECTIVES IN VIBRATION STUDIES OF VEHICLES AND HUMAN COMFORT

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ABSTRACT

Plying on rural as well as urban roads, the three-wheeled passenger vehicles are widely used to transport man and material economically, over short distances in India. Travelling at high speeds, the automobiles experience a broad spectrum of vibrations, which is transmitted to the passengers either by physical, visual or aural means. The vehicle designer has to address conflicting demands, when the vibration isolation requirement necessitates the use of a softer suspension spring while a better road- holding capability demands a stiffer suspension spring. Dynamic simulation programs permit shortening of the design process by avoiding the burden of expensive and time- consuming modifications in hardware and expensive tests on the prototype. Obviously, in order to make dynamic simulation program a effective tool for the designer, the mathematical model of the vehicle must be carefully prepared in order to match as far as possible the behaviour of the real vehicle. The factors to be considered in evaluating the ride performance of a vehicle are the ride comfort of the driver and the passengers, as well as the cargo and the ride safety. Ride comfort, which is normally interpreted as the ability of the vehicle suspension, for a particular vehicle configuration, to maintain the motion within the range of human comfort, as well as within the range necessary to prevent any damage to the cargo. Parametric analysis of the vehicle would provide the vehicle designer, vital information regarding the extent to which each parameter influences the PSD or RMS acceleration response of the vehicle, when moving at a constant speed. This information can be utilized to arrive at a suitable combination of the design parameters, which can aid in keeping the peak value of accelerations within the ISO comfort boundaries, resulting in an improved ride. Travelling by railway trains today, is considered a preferred mode of transport for long distance travel, which along with ride comfort, allows the passengers to carry out sedentary activities like reading, writing, working on laptops etc. There are, however, several significant factors inside the train environments that impede the performance of such activities. The vibration is a major factor influencing the performance of sedentary activities during the travel. Moreover, passengers during travel adopt different postures to attenuate the vibration in order to perform their activities satisfactorily. The available standards do not include the effects of vibrations on passenger activities. Economic viability of a transport vehicle can be maintained only when the design engineer has knowledge of the effect of vibration stimuli and posture on passenger comfort. This information needs to be available well in advance of the vehicle design since major alterations in design are expensive and, after the vehicle has been built, these are impracticable. Therefore, in order to provide a suitable environment for satisfactory performance of sedentary activities, an assessment of activity discomfort due to whole-body vibration (WBV) needs deliberation. An enhanced knowledge about the transmission of vibration through the body will lead to better understanding of how whole-body vibration influences the comfort, performance and health. Furthermore, to minimize the transmission in the body, it is necessary to have understanding of adverse effects of vibration. It would be impractical to carry out the study on trains, as there would have been very little experimental control. In view of the above, present research work reports experimental investigation of the influence of single and multi-axis whole-body random vibrations on the ability to perform various sedentary activities in different subject postures. Humans are most sensitive to whole body vibration under low-frequency excitation in seated

posture. As a result, biodynamics of seated human subjects has been a topic of interest over the years, and a number of mathematical models have been established. Human body is a complex dynamic system, the properties of which vary from time to time and from one individual to another and poses a lot of challenge in modelling. While much research has been carried out on building up specific biodynamic models based on certain experimental data under prescribed testing conditions, a thorough investigation of mathematical human models has not yet received the same level of attention. Biodynamics of the human system is one of the important foundations for understanding mechanisms of whole body vibration induced disorders and for developing better standards for assessing risk of vibration exposure. Knowledge of the biodynamic responses is also required for designing and assessing vibration isolation methods and developing whole body vibration simulators for analysis and testing of vehicles in automotive industry.

The biodynamic responses of the human body influence the manner in which vibration causes discomfort and injury and interferes with activities. Purely numerical considerations of body dynamics have been reported, but the complexity of the human body dictates a vital role for experimentation in the development of understanding of human responses to vibration. As humans are most sensitive to whole body vibrations under low-frequency excitation, knowledge of the biodynamic responses is required for designing, analysis and testing of transport vehicles with an aim to improve passenger and driver comfort. A biodynamic model based on anthropometric data of Indian male subjects has been discussed. Seat to head transmissibility values have been evaluated and the effect of different vibration magnitudes and excitation frequencies on it has been obtained.

BIO-SKETCH

Dr. V. Huzur Saran is an Associate Professor at Department of Mechanical and Industrial Engineering Indian Institute of Technology, Roorkee. Dr. V. Huzur Saran completed his Ph.D (Mechanical Engg.) I.I.T. Roorkee, 2004, followed by M. E. (Machine Design) Roorkee University, Roorkee, 1987 & B.E. (Mechanical Engineering) Agra University, Agra, 1984. His teaching covers the topics of Theory of Machines, Solid Mechanics, Machine Design, Engineering Graphics, Engineering Drawing & Advanced Machine Design and Dynamics of Road Vehicles. He has over 40 renowned publication on his research works

KEYNOTE TALK 10

RADAR CROSS SECTION ANALYSIS OF A THIN MATERIAL STRIP: A WIENER-HOPF APPROACH

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ABSTRACT

The analysis of the scattering by material strips is an important subject in electromagnetic theory and radar cross section (RCS) studies. Volakis [1] analyzed the H-polarized plane wave diffraction by a thin material strip using the dual integral equation approach [2] and the extended spectral ray method [3] together with approximate boundary conditions [4]. Volakis first solved rigorously the diffraction problem involving a single material half-plane, and subsequently obtained a high-frequency solution to the original strip problem by superposing the singly diffracted fields from the two independent half- planes and the doubly/triply diffracted fields from the edges of the two half-planes. Therefore, his analysis is not rigorous from the viewpoint of boundary value problems and may not be applicable unless the strip width is relatively large compared with the wavelength. This problem has been solved more recently by Shapoval et al. [5, 6] by using the generalized boundary conditions and the singular integral equation. In this paper, we shall reconsider Volakis's problem, and analyze the plane wave diffraction by a thin material strip with the aid of the Wiener-Hopf technique [7-9]. Both E and H polarizations are considered. The geometry of the strip is shown in Fig. 1. Introducing the Fourier transform of the scattered field and applying approximate boundary conditions in the transform domain, the problem is formulated in terms of the simultaneous Wiener-Hopf equations, which are solved exactly via the factorization and decomposition procedure. However, the solution is formal since branch-cut integrals with unknown integrands are involved. By using a rigorous asymptotic method we have developed recently [10], we shall derive a high-frequency solution of the Wiener-Hopf equations, which is expressed in terms of an infinite asymptotic series and accounts for all the higher order multiple diffraction effects rigorously. It is shown that our solution is valid for the strip width greater than about the incident wavelength and requires numerical inversion of an appropriate matrix equation. The scattered field in the real space is evaluated asymptotically by taking the Fourier inverse of the solution in the transform domain and applying the saddle point method. It is to be noted that our final solution is uniformly valid in incidence and observation angles. Numerical examples of the RCS are presented for various physical parameters and far field scattering characteristics of the strip are discussed in detail. Some comparisons with the existing literature are also given. Main results presented here are published in our recent papers [11, 12].

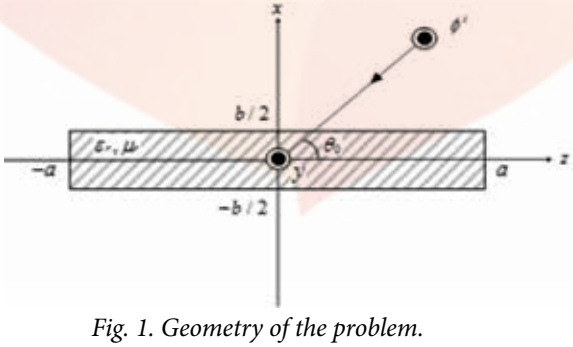

Fig. 1. Geometry of the problem.

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BIO-SKETCH

Dr. Kazuya Kobayashi received his B.S., M.S., and Ph.D. degrees, all in electrical engineering, from Waseda University, Tokyo, Japan in 1977, 1979, and 1982, respectively. In 1982, he joined the Department of Electrical, Electronic, and Communication Engineering, Chuo University, Tokyo, Japan, where he has been Professor since 1995. He is a Member of Science Council of Japan and a Fellow of The Electromagnetics Academy. He has held various URSI positions including, Assistant Secretary-General for AP-RASC (since 2015), Vice-Chair (2014-2017) and Chair (since 2017) of Commission B, Chair of AP-RASC Standing Committee (since 2015), and President of the Japan National Committee of URSI (2008-2018). He is currently involved in organizing URSI AP-RASC 2019 (March 2019, New Delhi, India) as General Co-Chair and URSI EMTS 2019 (May 2019, San Diego, California, USA) as Chair of Technical Program Committee. His research area includes, developments of rigorous mathematical techniques as applied to electromagnetic wave problems, integral equations, boundary value problems, special functions, radar cross section, and scattering and diffraction

KEYNOTE TALK 11

ELECTROSPUN NANOFIBER TECHNOLOGY AND ITS COMMERCIAL OPPORTUNITIES: FUTURE STARTUPS TREND

Dr. Sandip Patil
Director, E-Spin Nanotech, INDIA

ABSTRACT

Nanotechnology is being used in many fields including electrical, building materials, sensors, cosmetics and even in the agri-food industry. The interesting characteristics of electrospun nanofibres (NFs), such as high surface-to-volume ratio, nanoporosity, and high safety, make them suitable candidates for use in a variety of applications. In the recent decade, electrospun nano-fibres have been applied to diff erent potential fields such as filtration, wound dressing, drug delivery, etc. and a significant number of researches have been done in these fields.

In the recent decade, nanofibres have been considered an important group of one- dimensional nanostructures because of their unique properties such as high surface area, high porosity and their high safety in comparison with other nanomaterials. Some methods including phase separation, self-assembly, interfacial polymerisation, and spinning have been developed to produce nanofibres, among which electrospinning is the most widely studied technique. A typical electrospinning system contains a high-voltage electric field, a syringe with a metal needle, and a metal collector. A polymer solution or melted polymer with sufficient molecular entanglement is injected into a metal capillary using a syringe pump. The electric field which is applied between the capillary tip and the conductive electrode induces an electric charge in the fluid, which in turn generates an electrostatic repulsion. When the voltage reaches a critical value under which a Taylor cone is formed, electrostatic repulsion overcomes the surface tension of the polymer solution, and an electrically charged jet of the polymer is ejected and directed towards the collector with an opposite charge. Before the jet reaches the collector, its solvent is evaporated, and polymer nanofibres are solidified on the collector. Electrospinning nanofiber technology has several advantages over other production methods such as ease of use and being cost-effective, production of fibres in a diameter range of lower than 100 nm. During spinning this method allows us easy incorporation of active materials such as drugs, vitamins, antioxidants, metallic nanoparticles, etc. into nanofibres. Most importantly, the absence of heat in the conventional electrospinning process (which can be of key importance especially in the case of food materials and pharmaceutical), and the formation of nanofibres of both organic and inorganic materials. This talk focus on electrospinning nanofiber technology for various industrial applications which includes, energy devices, battery separator, biomedical application, air filtration, membrane technology, aerospace technology, photovoltaic devices, energy storage devices and management.

BIO-SKETCH

Dr. Sandip Patil is an alumnus of IIT Kanpur. He holds a doctorate degree in Chemical Engineering and has a vast experience in the field of Nanotechnology and Adhesives. Several of his works on Adhesion have been published. He is also a co-inventor of an Indian patent on composite reusable adhesive and that of a US patent which is under process. Some of his innovative work on fabrication of composite reusable adhesives has been covered under scientific news in CNN U.S. edition and Mint and the Wall Street Journal. He has won several accolades including the Technopreneur Promotion Program (TePP) award for fabrication of low-cost lab scale electro-spinning machines and the prestigious IICHE M. P. Chary Memorial Medal for being an outstanding young chemical engineer for the year 2012. His innovations have also been presented in various international conferences including Society of Rheology and Society of Adhesion in the area of novel engineering material development.

KEYNOTE TALK 12

ROBOT VISUAL NAVIGATION IN AN UNKNOWN ENVIRONMENT

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ABSTRACT

This study presents a vision-assisted robot navigation system. The major objective of the system is to assist the robot implementing the tasks of localization and mapping in the environment where the global positioning system (GPS) is denied. The visual sensor provided measurement data for estimating the robot state and building the environment map. The position of the landmarks was initialized using the non-standard stereo geometry method (non-SSG). The states of robot and static objects were recursively predicted and estimated using estimation methods. When the range of the environment map was too large, the computation time increased dramatically. Real-time implementation of robot visual navigation became an impossible task. To improve the problem, many approaches were proposed in this study. The software program of the robot navigation system was developed in a PC-based controller using Microsoft Visual Studio C++. The navigation system integrated the sensor inputs, image processing, and state estimation. The resultant system was used to perform the tasks of simultaneous localization and mapping (SLAM) for large environments. An autonomous robot relies on sensing information to know the outside world and estimate the state of the robot itself in an unknown environment. Commonly used sensors include the global positioning system (GPS), laser range finder (LRF), and vision sensor. A GPS signal is not available for robot in an indoor navigation. The LRF can offer high- precision measured data, but it is too expensive to be extensively used. The vision sensor has a reasonable cost and is generally used as a robot' s sensing device, especially in a GPS- denied environment. Considering the carrying capacity of an autonomous robot, a single camera was used in this study, and the image was transmitted to PC-based controller for image processing using a radio frequency module. The monocular vision sensor captured two-dimensional images but lacked depth information on the objects. Without depth information, the location of a new landmark could not be determined; meanwhile, the map scale of the environment could not be initially estimated. For monocular vision, many researchers have developed time-delayed and undelayed procedures for landmark initialization. This study used the undelayed method. The spatial coordinates of the image feature were calculated using the method of inverse depth parameterization. However, the problem of determining the map scale remained unsolved. In this study, an ultrasonic sensing system was developed to provide one-dimensional distance measurements and to solve the map scale determination problem of monocular vision. The contribution of this paper is the novel procedures for building global map from a group of local maps. To build a persistent map of an environment, an efficient algorithm for dividing the environment map into many local maps was developed in this study. The procedures include a search of image features located at the predicted location in the image plane, as well as the calculation of the Euclidian distance between the descriptors of image features. Two method based on fixed-value levels and fuzzy rules were designed for data association. We also extended the usability of a persistent map and the data association methods developed in the tasks of simultaneous localization and mapping (SLAM). Estimation methods were used in SLAM tasks to recursively predict and estimate the robot state and the states of environmental landmarks.

BIO-SKETCH

Dr. Yin-Tien Wang is a Professor in Department of Mechanical Engineering in Tamkang University. Dr. Yin-Tien Wang completed his B.S. Mechanical Engineering from Tamkang University, Taipei, Taiwan, in 1983 followed by M.S., Mechanical Engineering Stevens Institute of Technology, Hoboken, NJ, USA in 1988 & his Ph.D. in Mechanical Engineering and Applied Mechanics from University of Pennsylvania, Philadelphia, PA, USA in 1992. Currently Dr. Yin-Tien Wang is affiliated with institution of Electrical and Electronic Engineers (IEEE), Chinese Institute of Automation Engineers (CIAE), Chinese Automatic Control Society (CACS), Robotics Society of Taiwan (RST), Institute of Electronics, Information and Communication Engineers (IEICE), Japan. Dr. Yin-Tien Wang has done 78 publication in his academic professional life.

KEYNOTE TALK 3

NUMERICAL SOLUTIONS OF CRACK GROWTH PROBLEMS USING XFEM

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ABSTRACT

The study of fracture failure in engineering components and structures is of great importance as it finds critical applications in structural, mechanical, aerospace, robotics and biomedical fields. Fracture mechanics deals with the design and analysis of structures, which contain defects or flaws (cracks, pores, inclusions, grain boundaries, etc.) either at microscopic or macroscopic level. The external loading on the components/ structures may result in the propagation of pre-existing cracks or may initiate new cracks, which finally lead to the catastrophic failure of the components. Over past few decades, greater understanding in physics of fracture failure has undoubtedly prevented a large number of structural failures. Over the years, the failure of the structures due to presence of cracks and cracks like defects is investigated with the help of analytical, experimental and numerical techniques. However, the fracture failure or crack growth analysis of structures of practical interest is nearly impossible by analytical approaches. The experimental methods can provide the solution of some practical problems, but they are quite time consuming, resource intensive and mostly limited to specimen level. Therefore, numerical methods is the only choice left to the users for solving fracture problems.

At present, a number of numerical methods such as finite element method (FEM), boundary element method, isogeometric finite element methods, meshfree methods and many more are available to model the crack growth behavior. Among these, the FEM has been widely used to simulate the crack growth behavior. Many commercial software (ANSYS, ABAQUS, COMSOL Multiphysics, ADINA, NASTRAN) and open source codes are available today to model the cracks. However, FEA not only demands remeshing at each stage of crack growth but also requires special elements to handle asymptotic crack tip stresses. To overcome these issues, a novel approach, known as extended finite element method (XFEM) has been developed to model and simulate the crack growth problems. The XFEM allows the mesh independent crack growth modelling, and thus avoids remeshing during crack propagation. To model a crack/crack growth in XFEM, standard FE approximation is enriched with some additional functions, which are obtained from the theoretical background of the problems. In XFEM, the presence of crack is ensured by adding Heaviside and asymptotic enrichment functions in the standard FE displacement approximation through the notion of the partition of unity. For efficient implementation of XFEM, topology of the propagating crack is tracked using level set methods. In the present talk, the crack growth modeling in a geometry or structure is handled by XFEM. The fracture parameters such as stress intensity factors, J–integral will be evaluated numerically. The solution of various fracture mechanics problems such as quasi-static crack growth, fatigue crack growth, elasto-plastic crack growth, crack growth with frictional contact, multiple interacting cracks, crack growth in heterogeneous materials (FGM, Bi-materials, particulate composites) and crack propagation in 3-D structures will be discussed. The talk will also focus on the advancements in XFEM for the efficient solution of the problems involving discontinuities.

BIO-SKETCH

Dr. Indra Vir Singh is an Associate Professor at the Department of Mechanical and Industrial Engineering at Indian Institute of Technology Roorkee, India. His diligent and renowned work of research focuses on FEM, XFEM, Isogeometric Analysis, Meshfree Methods, Multi-scale Modeling, Phase Field Modeling, Constitutive Modeling, Fracture Mechanics, Fatigue, Damage Mechanics, Plasticity, Composites. Dr. Indra Vir Singh accomplished his B.Sc. Engg. (Mechanical) from A.M.U Alighar in the year 1996, followed by M.Tech. (Applied Mechanics) & Ph.D. (Mechanical) from I.I.T. Delhi 1998 & Birla Institute of Technology, Pilani in the year 2004 respectively. In his career so far, Dr. Indra Vir Singh have published over 212 publication In his field of expertise.
Dr. Indra Vir Singh is also an active member of Indian Association for Computational Mechanics, Indian Society of Theoretical and Applied Mechanics, International Association of Engineers.

KEYNOTE TALK 14

LARGE EDDY SIMULATIONS (LES) OF TURBULENT CHANNEL FLOW SUBJECTED TO A LARGE TEMPERATURE GRADIENT

Dr. Syed Fahad Anwer
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ABSTRACT

Large Eddy Simulations (LES) of a stably stratified, turbulent channel flow, subjected to a large temperature gradient have been performed by considering a broad spectrum of stratification. Due to a large thermal gradient across the channel, temperature-dependent fluid properties like viscosity (μ), density (ρ), and thermal conductivity (κ) are considered as variables. Recent subgrid-scale models are evaluated in turbulent channel flow at friction Reynolds number = 180, using Low Mach number approach. The temperature ratio ($R^{\theta} = T_{hot}/T_{cold}$) is varied from 1.01 to 5 to study the isolated effect of variable viscosity with (T_{hot}) and (T_{cold}) as a wall temperature.

The models considered were chosen among those performing best in decaying isotropic turbulence, following the study by Winckelmans &Jeanmart[14], the dynamic Smagorhisky model (used as a baseline); We consider several different subgridscale models for thermal part and kinetic part. For modeling subgrid stresses, we have used Dynamic Smagorinsky model developed by Germano et al[6] and a Wall Adaptive Layer Equation (WALE) model suggested by Nicoud and Ducros[12]. For thermal part, we have used a dynamic model and a mixed scale model. The last three models put more emphasis than the Smagorinsky model on the subgrid-scale (SGS) dissipation at small scales, leading to significant improvement of the results in isotropic turbulence.The models are assessed and compared to the direct numerical simulation (DNS) data of Moser, Kim & Mansour[9] on the basis of mean profiles of velocity, rms velocities and reduced (deviatoric) turbulence intensities.

Role of thermo-fluid properties adversely affect the turbulent structures and shows evidence of relaminarization at the hot wall of the channel. Role of internal gravity wave, its behavior in Bousinesq and non-Boussinesq situation is elaborated via turbulent structure and energy spectra for turbulent channel flow of air with varying viscosity and thermal conductivity. Due to temperature dependent properties internal gravity wave shifted towards hot wall from the core of the channel. It is shown that average and turbulent fields undergo significant changes in a broad range of Reynolds number, compared to isothermal flow with constant viscosity, we observe enhanced turbulence on the cold side of the channel, characterized by locally lower viscosity whereas a decrease of turbulent kinetic energy is found at the hot wall. The turbulent structures via H criteria of high vorticity shows very short and densely populated vortices near cold wall whereas long streaky structure or large elongated vortices at the hot wall. Q invariant totally eradicate all the streaky structure at the hot wall as a consequence of relaminarization. To further clarify this issue spectral study is conducted that reveals complete suppression of turbulence at the hot side of the channel at large temperature ratio because no inertial zone (i.e. index of Kolmogorov scaling law is zero) is obtained on the spectra in these region.

With increased stratification, a cluster of laminar patches appears in the near-wall region, and turbulent momentum and buoyancy fluxes are suppressed drastically in the core of the channel due to the formation

of internal gravity waves. Variable viscosity results in flow relaminarization on the hot side of the channel (where viscosity is higher). Density tends to stablize the flow by blocking the upward movement of thermal plumes, while thermal conductivity pays the toll for viscosity at high Reynolds number. A mechanistic model for wall heat transfer is developed for buoyancy-effected flows. We have observed qualitatively and quantitatively the pronounced modifications in turbulent structure and flow statistics

BIO-SKETCH

Dr. Syed Fahad Anwer obtained his bachelor's and master's degree in mechanical engineering and Thermal Science with a specialization in CFD from Aligarh Muslim University in 2000 and 2002 respectively. He then proceeded to Department of Applied Mechanics, IIT, New Delhi and completed his Doctorate in 2006. He was awarded the Best Post graduate project at IIT Delhi in 2006 for his doctoral work. After Ph.D, he proceeded to Laboratoire d'Informatique pour la Mecanique et les Sciences de I'Ingenieur, (LIMSI), Paris, France on CNRS fellowship to complete a Post-Doctoral programme in 2009-2010. Since then he is serving in the Department of Mechanical Engineering, ZHCET, AMU Aligarh. He has also served as Visiting Faculty in the Department of Mechanical Engineering, IIT Kanpur in 2015-16. His research interests are Turbulence, High Temperature Gradient Flows, Non Oberbeck-Boussinesq Flows, Heat Transfer in Enclosures and Annuli, Insect Aerodynamics, Fluid Structure Interaction. His Major Research Publications include Journal of Computational Physics, Physics of Fluid, Computers and Structures, Numerical Heat Transfer Part A: Applications, Industrial Engg and Chemistry Research, International Journal of Thermal Sciences, Heat Transfer Engineering.

KEYNOTE TALK 15

NUMERICAL SIMULATION OF SUBMERGED TURBULENT JETS IN DEEP WATER HORIZON OIL LEAK- CHALLENGES AND ACCOMPLISHMENTS

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ABSTRACT

The topic of oil spilling into water is largely associated with oil exploration in under water oil-blowout. However, the underwater oil spill has received viable attention to research community in recent years, after the accidental Deepwater Horizon blowout in the Gulf of Mexico in 2010. Though substantial research articles have outlined the transport mechanism of oil-spill within surface water, knowledge on submerged oil blowouts is scare in the literature. Estimation of discharge rate from a deep-sea oil leak jet require an in-depth understanding of the transport characteristics of the turbulent oil jets. Unfortunately, the oil-jet from blowout is highly opaque which prevents direct measurement of velocity profiles inside the oil jets. The standard approach is to measure the velocities of visible features such as turbulent eddies, vortices at the outer edge boundary of jet and subsequently classical theory of turbulent jets is then applied on the boundary velocity to determine the mean velocity over the cross-section of the opaque oil-jets. This approach was first developed by the Flow Rate Technical Group (FRTG) Plume Team during the response to the Deepwater Horizon (DWH) oil leak. Manual tracking of visible features produced the first accurate government estimates of the oil discharge rate from the DWH. However, for this approach to be practical, a well proven technology is needed to quickly and accurately measure the discharge rate from a submerged oil leak jet. In the current work, we will discuss the challenges encountered in applying the theory of classical turbulent jet on the highly opaque oil jet through the analysis of experimental and as well as CFD investigations. The work will report the experimental results of an underwater horizontal turbulent oil jet released from a long-submerged pipe of diameter 1 inch, giving a discharge rate of 270GPM, conducted at UC Berkeley and OHMSETT. Numerical simulations of submerged turbulent oil jets have been performed to reduce the coherent vortical structures representative of visible features. The computations have been conducted using finite volume based open-source CFD solver OpenFOAM . Large eddy simulation (LES) approach for turbulence closure and volume of fluid (VOF) method as interface capturing technique have been employed. The study considers a fully developed turbulent oil jet from the exit of a submerged pipe discharged into a cylindrical space initially filled with quiescent salt water. The fluid properties, jet diameter, discharge flow rate and the computational domain size have been obtained from experimental study. The first challenge is to identify the boundary of immiscible oil leak jets from CFD data, that define the visible features at the outer edge boundary of real oil spill. This has been achieved through the visualization of the edge of statistical jet boundary and identification of coherent vortical structures. The simulated results have been analyzed in terms of contour plots of volume concentration of oil, streamwise edge velocity and velocity vectors. The coherent large-scale turbulent structures have been quantified using second invariant of instantaneous strain rate tensor. The contours of second invariant and the superimposed edge velocity identify the statistical jet boundary concurrently. The simulated results capture jet spreading and jet structures in close agreement with the experimental observations. Detailed study attempts to highlight the jet structures, evolution of jet plume.

BIO-SKETCH

Dr. Pankaj Saha is a Research Engineer at the West Virginia University Research Corporation and working at the Advanced Thermal Science division at US-DOE National Energy Technology Laboratory (NETL), West Virginia, USA. He received his Ph.D in Mechanical Engineering specializing on Fluid and Thermal Science from IIT Kanpur, India, in 2012. He was a postdoctoral fellow in the department of Mathematics at University of Wyoming, USA, in 2013-2014 and worked as ORISE-ORAU postdoctoral research fellow in the Multiphase Flow Science and Advanced Thermal Science divisions at NETL, in 2014-2017. At Wyoming, he assessed a new turbulent structure preserving hybrid turbulence model for wall bounded and separated flows. At NETL, he developed a plume analysis tool to estimate the discharge rate from a submerged oil leak jet at Deep-water Horizon oil leak employing LES simulation and investigated a very challenging practical purpose problem of estimation of mixing performance of miscible fluids in Pulse jet mixing (PJM) vessel under various operating conditions. At his current position, he is conducting performance analysis of pressure gain combustion cycle in rotating detonation engine using both CFD and experimental observations. Primarily, he is developing a robust unique compressible reactive CFD solver using OpenFoam software to accurately capture deflagration, detonation and transition phenomena relevant in detonation combustion process. His primary research interests involve CFD, Turbulence modeling, heat and fluid flow analysis, turbulent reacting flows, gas turbine technology and pressure gain combustion, heat exchanger design. He has published many journal and conference articles, book chapter, attended conferences and workshops, actively involved as journal reviewer and academic society member (APS, ASME).

KEYNOTE TALK 16

INDUSTRY 4.0: CHALLENGE OR CHANCE FOR AN SME – TOOLS FOR EFFICIENCY

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ABSTRACT

The current trends and the parallel developments and innovations in manufacturing and production are called as Industry 4.0 based on the program announced by the German Government in 2011 [1]. This name refers the symptoms and answers can be recognized all over the world and commonly consider as the 4th industrial revolution. This term has been criticised both from industry and from science because a continuous development and innovations resulted the elements and technologies of it. Major question if the processes behind the change in Industry 4.0 can be considered as revolution that usually means radical and quick alteration parallel in economics and in society and in industry, too.

After analysing the nowadays processes several radically new behaviours and working models can be recognized. Here only the four essential momentums are pointing out: in society new consuming and new ownership behaviour arose, in economy new organizing end enterprising strategies manifested, in industry (and in other sectors) new technologies were developed [2].

It is not a goal any more for the Z generation to possess things like cars, weekend house etc. They prefer to rent or using shared things e.g. car-sharing services such as Zipcar [3] or Airbnb home sharing for travellers. We call this economy as sharing or on-demand economy. Another approach can be the collaborative consumption that is regularly organized on a platform such the Facebook (platform economy). On the other hand this platform economy demonstrate the new organization concept of the economy. You may find the partners using different platforms that organize its members for other common interests and aims. Using the platform the service and the demand find each other accidently, however the efficiency of this platform economy seems very high (e.g. Google). When you start to open a new international enterprise it is not necessary big investment or network of factories. It is enough a good idea, a computer with network connection to organize the service providers or the suppliers (Notch Sensor Ltd.). These examples should convince anyone that Industry 4.0 is a real revolution indeed, which resulted dramatic change in social and economic environment, too, and also rearranged the industry.

In industry, and especially in production the revolution brought new technologies and these new technologies may imply quicker responses, reliable working and higher efficiency in companies. Many of the applied technologies existed earlier (CAD/CAM software, AI computation, sensor-based monitoring, models and simulation of the working environment, robotics etc.) However, some new technologies also appeared in the last decade such the 3D printing, the collaborative robots, the drones or the autonomous vehicles and the cloud services. The most important new achievement that produce the revolutionary change must be the connectivity that is called as Internet of Things and generate the cyber-physical production system which monitors the physical (real) production and ensure the connectivity for humans and the cooperation of the machines, robots, humans, manufacturing cells and systems [4].

In the last years the international mega companies started to use the new technologies and to turn into the industry 4.0 developments. They have the necessary resources, and sharp demand to increase the efficiency providing these tools. The first results demonstrate the difficulties of the new technologies and, on the other hand, their advantages as well. In figure 1 the relevant contradictions gave rise by the introduction of Industry 4.0.

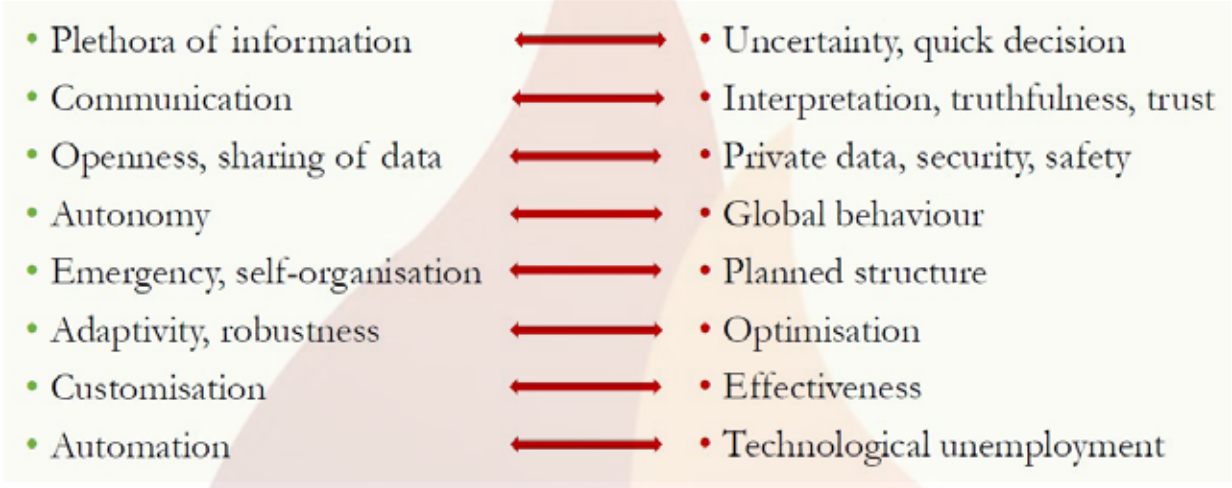

Figure 1 Dilemmas to be resolved in Industry 4.0 [5]

SMEs (small and medium size enterprises) in rich and industrialized countries (like Germany, the USA) started partly to introduce the new tools, but expenses that would be necessary even for the first steps seem too high for the smaller owners and the return of the investment still questionable. There is no doubt that collecting bulk of data would help to optimize the production and after developing the appropriate data mining software and optimizing algorithms – that is expensive and time-consuming investment – big companies will produce even better efficiency the can win the competition. Application of the new technologies, techniques, tools provides better quality, higher productivity, may solve the demand of employees. What ways remained for SMEs to access the advantages of the Industry 4.0?

The altered behaviour of the society and rearranged economic strategies in 4th industrial revolution give the chance for SMEs. They must use the collaborative consumption and sharing economy solutions in industrial environment, which helps to reduce the expenses incurred, and to avoid the mistakes that others made. However without some support from the government and appropriate guidance of advisory institution providing the frame of this solution companies will be a day after the fair.

The European Union in H2020 program supported the Teaming project under grant No. 739592 named EPIC that provide the advisory frame for SMEs in Central-Europe. In this project – as a participating partner – Budapest University of Technology and Economics (BME), together with a powerful institution of the Fraunhofer Gesellschaft and a Hungarian research institute SZTAKI started to develop customizable and affordable solutions and services for interested SMEs. In a Technology Centre at the BME the key technologies are demonstrated like application advantages of collaborative robotics, introduction of manufacturing system optimization using digitalized configuration table, localization system for tracking logistical objects, application of digital twins in user friendly programming the CNC equipment and in virtual set-up of new production systems.

The EPIC Center of Excellence also cooperates with Industrial companies and develop customized and turnkey solutions. In the presentation some examples of the key technology demonstrations and of the industrial development will be introduced.

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BIO-SKETCH

Dr. Tibor SZALAY, Ph.D, associate professor, head of the Department of Manufacturing Science and Engineering at the Budapest University of Technology and Economics. His main research interests are the theoretical and experimental investigation of micro cutting. Parallel his other research focus is the measuring and supervision of cutting process. In the past years he was the Hungarian coordinator of two EU FP6 projects and he is responsible the participation of the BME in the H2020 Teaming project Center of Excellence Production Informatics and Control (EPIC) currently. He was awarded the Knight's Cross of Order of Merrit of Hungary in 2015.

INDUSTRY PARTNER TALK

Siemens PLM

Mr. Gautam Dutta

Gautam has about 30 years of experience in IT and PLM industries and has held leadership roles in organizations like TCS, IBM, Silicon Graphics, PTC and ANSYS. Currently, he is Senior Director Marketing with Siemens PLM Software in India.

Gautam is an alumnus from Delhi College of Engineering & IIT Madras. He is passionate about his profession and avidly contributes towards the efforts of "Excellence" initiatives of Indian Manufacturing community and towards making engineering the preferred profession for the new generation.

His special area of interest and practice through these years has been with Product development & Integrated Manufacturing and business transformations through products, processes and people.

PRESENTER

Name	**Mr .Khushpreet Singh**
Designation	Senior Application Engineer
Company	Siemens PLM.
Profile	• Having overall industry experience of 7 years. • Managing technical portfolio for Siemens Simulation Solutions. • Started career with Thermax India after completing B.Tech Mechanical from Punjab Technical University.

SESSION CHAIR

Prof. (Dr.) Surjit Angra is presently working as professor in the Department of Mechanical Engineering, National Institute of Technology Kurukshetra. He has guided/guiding 11 Ph.D theses and 52 M.Tech dissertations. He has published more than 85 research papers in his research work in the International Journals like Tribology letters, Journals of ASME, Tribology International, Journals of Reliability and system safety, journal of Engg. & amp; Material Science, Journal of IEI and proceedings of ISME.

Dr. Nathi Ram Chauhan is working as an Associate Professor & Training and Placement Officer (TPO) in the Department of MAE, IGTU- New Delhi. He is currently supervising Ph.D in the field of Tribology, Fluid Film Bearings, Alternate Fuels, Composite Materials, Manufacturing and Automation, Robotics and Automation. He has published more than 60 papers in International/National Journals and Conferences of repute.

Dr. Raveesh Kumar presently working at Laser Science and Technology Centre (DRDO) Metcalfe House, Delhi -54 as scientist G. His area of expertise are Cryogenic Engineering, Miniature Cryo-coolers, Applied Cryogenics,Thermal management Systems (PCM, Cryogen,Thermo-electric based) for Laser Systems. Dr. Raveesh Kumar's commendable experience includesworking at NPL, Dew Delhi. Experience in R&D of J-T coolers and Stirlingliquefiers for more than three years and more than 30 years (1987 - till date) at Laser Science and Technology Centre Metcalfe House ,Delhi. Experience in Research & Development/Product Development of various ThermalManagement Solutions of High Power Laser Systems, Miniature Cryo coolers & InfrastructureDevelopment. Dr. Raveesh Kumar has more then 15 publication upon his name as well as a patent.

Dr. Vinod Kumar is presently working as Associate Professor in the Mechanical Engineering Department, National Institute of Technology Kurukshetra. He has published more than 60 research papers in variousjournals and conferences. He has guided 39 M.Tech dissertations and is guiding 8 doctoral students.He is a life time member of IEI, Tribology Society of India, ISTE, ISTAM, SFST, SAE and Indian StructuralIntegrity Society.

Dr. Bahni Ray is an Assistant Professor in Mechanical Engineering Department-IIT Delhi. She completed her doctorate in IIT Kanpur after which she did her Postdoc in City College of NewYork and Johns Hopkins University. She works extensively on understanding fundamentalphysics of multiphase systems. She has authored 14 international papers in reputed journals.

Dr. P.C. Tewari is, currently Professor in the Department of Mechanical Engineering at NITKurukshetra (Haryana).His major areas of academic and research interests are Performance Evaluation andOptimization, Decision Support System, System Behavioural Analysis, Maintenance ResourceAllocation (especially for Process Industries), Statistical Quality Control and ReliabilityMaintenance Engineering, Total Productive Maintenance. He has guided about 30 B.Tech. Projects, 25 M.Tech. and 11 Ph.D. dissertations. At present, he isguiding 4 Ph.D. and 2 M.Tech. research scholars in the field of Industrial Engineering. Recently, hehas authored one Text Book on Work Study and Ergonomics.He has published more than 250 research papers in National and International Journals andchaired many technical sessions of national and international conferences.

Dr. Sorabh Gupta is working as Campus Director, RPIIT Technical and Medical Campus located at Chandigarh since last 07 years and having a vast experience of 21 years the field of teaching, research and administration. His field of interest is Modeling Stochastic Behaviour of system in Industry, Maintenance Engineering and Reliability Analysis. He is guiding 03 Ph.D theses and has supervised 31 M.Tech dissertations. He has published more than 55 research papers in International/National journals and Conferences. He is Fellow of the Institution of Engineers (India). He is life member of the Indian Society of Technical Education.

Dr. Amit Gupta, is working as Professor in the Departmentof Mechanical Engineering at Geeta Engineering College, Naultha, Panipat, Haryana, India. Hisresearch interests include industrialengineering and system design, reliability modelling & analysis, andpower & energy engineering. Dr. Guptahas published a number of researchpapers in International journals andconferences and guided a number Master's degree Dissertations.

Dr. Dinesh Khanduja is currently Professor in Mechanical Engineering Department at National Institute of Technology, Kurukshetra (Haryana). He also guided sixteen PhDs in areas of TQM, Six Sigma and Business Incubation as well as guided 32 projects and dissertations for MTech at NIT, Kurukshetra. He did Industrial consultancy to Small and Medium Industries (SME's) on different projects as well as completed one World Bank project under TEQIP at NIT, Kurukshetra. His teaching interest surrounds Total Quality Management, Entrepreneurship and Business Incubation, Six Sigma.

Dr. Sachin S. Gautam is currently an Assistant Professor in Department of Mechanical Engineering at IIT Guwahati. He primarily worked in the area of dynamic adhesive contact problems developing novel time integration schemes. Before that he finished his Ph.D. in Mechanical Engineering from IIT Kanpur working with Prof. P. M. Dixit on the area of simulation of high impact fracture using continuum damage mechanical model. He has published 3 book chapters, 10 journal papers, 35 conference papers and 2 referred conference proceedings, and 5 journal papers are currently. under review. His current area of research is in Nonlinear Finite Element Analysis, Computational Contact Mechanics, Iso-geometric Analysis, Adhesion, GPU Computing. He is also working with VSSC, ISRO, Trivandrum for developing contact module for their FE software FEAST.

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ADVANCES IN THERMAL AND FLUID ENGINEERING

Paper No:ATFE#05

Impact Assessment of Cooling Tower Uses and Its Application

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Abstract: Cooling tower have wide variety of industrial application. These are used as cooling systems that scale back the temperature of the water flow and transfer the warmth to the atmosphere. In basic cooling system, the packing acts as a media for transfer of mass and warmth. The thermal energy is bumped-off from the recent water then transferred to the cold and dry close air through direct contact. Though the packing facilitates the distribution of water and build a good contact surface between the air and water, they are vulnerable to fouling, and as a result, may scale back the potency of the cooling over time. The existence of the packing additionally ends up in intense pressure loss within the system. To beat this drawback, larger amounts of electrical energy should be consumed. This work provides the various aspects of cooling tower application and uses in the Civil Engineering Design aspects.

Paper No:ATFE#08

Refrigerating Effect Produced by Engine Exhaust Heat

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Abstract. Many new technologies are appearing and developing in automobile field helpful for humanity. Vapour compression refrigeration technique used in Automobile vehicle that requires cooling effect inside the vehicle. Due to riding obtain excursionist comfortable and keep them in an optimal temperature range by refrigerating effect. In presence surging fuel cost, more fuel consumes, and the load supported on the combustion engines are observed as disadvantages. The Ambition of 'Refrigerating Effect Produce by Engine Exhaust Heat' system used in vehicle cabin to reduce the fuel consumption during comfortable excursionist using the running of air conditioning part. The compressor replaces to heat exchanger and heat coil. Heat exchanger using as energy source of produce refrigerating effect, and "REPEEH" is few mechanical powers being done by engine running of air-condition. After used this technology through producing refrigeration effect inside during riding the new module vehicle are below cost of present using refrigerating effect and increasing life of engine to consume fuel energy may be 35-40%. It's experiment surging of fuel coast and save in our country and based on economical saving and maintain the continuity in future of our country.

Paper No:ATFE#09

Experimental Investigation of the Performance of a Double-Pass Unglazed Transpired Solar Air Heater

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Abstract. This study presents an experimental investigation of the performance of a double-pass unglazed transpired solar air heater. The performance of the solar air heater was evaluated from the experimental data by energy and exergy analyses. The average thermal efficiency of the solar air heater was found to be 16.9% and 20.6% at the mass flow rate of 0.015 kg/s and of 0.019 kg/s, respectively. The average exergy efficiency was found to be 0.49% and 0.57% at the mass flow rate of 0.015 kg/s and 0.019 kg/s, respectively. The thermal effectiveness of the heater was 66.6% and 67.1% at the mass flow rate of 0.015 kg/s and 0.019 kg/s, respectively. The energy and exergy efficiencies and the thermal effectiveness increased with increase in the mass flow rate of air. The performance of this solar air heater is comparable to the conventional glazed solar air heater although it does not have any cover plate.

Paper No:ATFE#22

Performance Analysis of Refrigeration System Through Artificial Intelligence

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Abstract. In this paper, Artificial Neural Network model is represented for studying the Vapor Absorption Refrigeration System (VARS). The study and analysis of Vapor Absorption Refrigeration System is very complex. We know that the Generator temperature (Tg), Evaporator temperature (Te), Condenser temperature (Tc) and the Absorber temperature (Ta) affect the Coefficient of performance (COP), of the VARS [1]. In this study COP is calculated by the temperature dependence of Generator and Evaporator. By the use Synaptic weights which are obtained from the network we train of ANN for Tg and Te, we will get the desired output i.e. the COP. This simulation is widely used now a days for the prediction of the performance or optimum design of the refrigeration. In this paper, it is shown that how the artificial neural network is going to help giving us the best and suitable output for the performance of our refrigeration. Through this, changing the predicting and changing the weights of our inputs we can get the best output for our system.

Paper No:ATFE#25

Design and Simulation of Isolation Room for A Hospital

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Abstract. Hospital isolation rooms provide adequate comfort and suitable healthy environment for the recovery of patients. But the comfort level of a patient may vary due to various factors such as the diagnosed medical condition. For immunosuppressed patients or for those suffering from contagious or infectious diseases the Indoor Air Quality (IAQ), draught ratings and other factors must be monitored and set appropriately. Controlling the heating, ventilation and air conditioning (HVAC) systems has proved to be very effective in improving the ambient air quality and temperature in the isolation room. In this work, the unidirectional and mixed ventilation models for an isolation room are studied using CFD techniques. The positioning of the supply vent for immunosuppressed and infectious patients is obtained by comparing the results in light of the thermal comfort and the average resident time of the bacteria or contaminant inside the room. Co-relations are established for the location of air supply vent with the resident time of contaminant and also with the thermal comfort of the patient.

Paper No:ATFE#42

CFD Analysis of GM Pulse Tube with Functional Gradient Regenerator

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Abstract.The present research aims to establish a stable and reliable simulation of GM pulse tube using commercially available CFD software. In line with aforementioned objective, three major tasks have been addressed in detail. First, a GM pulse tube has been taken from the literature for analysis. Unlike the present state of the art, the present analysis has been carried out using multi-component models in 3D environment. Various components involved in a pulse tube have been modeled and the corresponding assembly model has been analyzed. The proposed approach introduces tremendous amount of numerical complexities which have been addressed in detail. The numerical result agrees to lowest temperature achieved experimentally with 95% accuracy. In second, the thermo-acoustic phenomena have been analyzed regarding work-done at various locations, which re-establishes the fact and phenomena which takes place in a double inlet GM Pulse tube. At last, functionally gradient regenerator (FGR) has been proposed to enhance the performance of pulse tube. This particular task has two major sections. The first section enlightens the modeling of functionally gradient porous material (FGPM) for analysis and the second section focuses on the realistic modeling from manufacturing point of view. Summarizing, the contribution establishes a practice to investigate a GM pulse tube in 3D component level together with an approach to the model functionally gradient regenerator.

Paper No:ATFE#46

Design and Numerical Analysis to Visualize the Fluid Flow Pattern Inside Cryogenic Radial Turbine

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Abstract. In this paper, the mean-line design and numerical analysis to visualize the flow field characteristics of the cryogenic radial turbine for the liquefaction of nitrogen are reported. The three-dimensional design of blade profile and a fluid passage is created using Blade-gen©. The meridional plane, hub, and shroud layers are optimized to increase the efficiency, minimize the vortex formation and losses in the fluid passage. Turbo-Grid has been used to create the computational grid. Numerical simulations are carried out using shear stress transport turbulence model using CFX© to visualizes the fluid flow behavior, high-pressure zone, heat transfer characteristics, vortex formation, pressure, velocity, Mach number, temperature, entropy generation, etc. using nitrogen as a working fluid. The blade loading characteristics, blade thickness and blade angle variation at leading and trailing edge are also being discussed.

Paper No:ATFE#56

Thermal Design and Numerical Analysis of Transportable Bitumen Storage Tank for Improved Liquefied Bitumen Supply

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Abstract. Asphalt Plant manufactures the hot black mix required for road construction. Bitumen is used as a binding agent that binds the aggregates (stones) together. Liquid bitumen ranging between 150°C – 160°C is sprayed on aggregates in a twin shaft mixer having mixer pads mounted on both shafts rotating in opposite direction with respect to each other (inwards direction). Hence asphalt plant needs the supply of hot and liquid bitumen, which is stored in storage tanks and is used as and when required. In this paper, the thermal design and simulation-based numerical analysis of 42000 & 50000liters capacity of transportable bitumen storage tank are presented. Usually, bitumen in the storage tank is heated by a thermal fluid called Therminol, having inlet temperature of 180°C, flows through tube bank present inside the storage tank. Therminol is heated by the fire-tube boiler. Thus effective heat exchanging system in the bitumen storage tank is crucial. In the existing storage tank, the solid bitumen rocks need 12 hours of heating to obtain liquid bitumen ranging between 150°C -160°C. Here, computational fluid dynamics (CFD) based simulations are carried out to design the effective heat transferring system. Various flow conditions of Therminol, as well as different tube bank configuration, are been simulated and presented. The CFD analysis shows that with proper and modified distribution of tube bank inside the storage vessel helps to improve the heat transfer by a factor 2-3 and hence is capable to liquefy bitumen within 6 hours.

Paper No:ATFE#69

Evaluation of Heat Recovery Steam Generator for Gas/ Steam Combined Cycle Power Plants

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Abstract. The combined cycle power plant consists of topping cycle, bottoming cycles and heat recovery steam generators (HRSG) as the integral systems. The main focus of this work is to predict and analyse fluid flow behaviour in HRSG. The heat transfer and pressure drop analysis is performed by using computational fluid dynamics (CFD) model. The CFD model capability for predicting heat transfer and pressure drop performance of finned tube in cross flow is analysed. The HRSGs having serrated tube and steady state approach, with a two-equation turbulence model, is employed to examine fluid flow having Reynolds numbers variation from 5000 to 30000. The external flow Nusselt number and overall pressure drop predicted by the CFD model are compared with those predicted by published empirical correlations.

Paper No:ATFE#80

Thermodynamic Investigation of Solar Energy Driven Diffusion Absorption Refrigeration Cycle

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Abstract. The increasing demand of refrigeration and air conditioning with associated consequence of global warming across the world has made it inevitable for scientific community to look for alternative of conventional energy sources and to minimize effects of CFC's and HCFC's on global warming and ozone layer depletion while facilitating the requirements of refrigeration and air conditioning. It is evident that the geographical locations on the earth having ample sunshine have more refrigeration requirements, however these locations also offer potential opportunity for utilizing solar radiations for solar energy driven refrigeration systems. This study focuses on the thermodynamic modelling and analysis of solar energy driven ammonia - water diffusion absorption refrigeration cycle with helium as pressure equalizing inert gas. It is seen that loss percentage in coefficient of performance (WPL and WHPL) is 2.8% than cooling capacity at low generator temperature while there is no marginal drops at higher temperature. It is also found that the generator temperature in the range of 110°C to 150 °C is best suited to produce maximum refrigerating effect.

Paper No:ATFE#89

Two-Phase Spray Impingement Density Determination in Microchannel Cooling Measurement and Optimization Results

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Abstract. Within the past few years electronic industry has developed vastly. Emerging technologies tends to increase demand for higher power densities in small dimensions. Hence, performance of the equipment's used for military or electronic industry needs high heat removal from small areas which directly increase its performance. Hybrid cooling which takes advantage of both microchannel and spray impingement cooling is considered as one of the best technologies for critical heat removal so far. Among all controlling parameters of spray, mass impingement density (MID) is considered as the most influencing parameter for high heat removal. This paper describes an experimental study to evaluate and optimize MID for different combinations of air and water pressure and nozzle to surface height during spray on microchannel. A mechanical patternator was used for collecting water during spray of base dimension 27mm x 25mm which was similar to the microchannel for which MID was calculated. The air and water pressures were varied from 1bar to 3bar for nozzle to surface height 10 to 20 mm. Optimal solution was found through Response surface methodology (RSM) which concludes at air pressure 1 bar, water pressure 2.87 bar and nozzle tip to surface distance 17.52 mm maximum MID is achieved.

Paper No:ATFE#103

Experimental Investigations into Performance Evaluation of Thermosyphon Solar Heating System Using Modified PCM Modules

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Abstract. The demand for effective and efficient use of solar heating arrangement is increasing in domestic and industrial applications. The existing renewable energy resources are intermittent and fluctuate depending upon the meteorological conditions. So the main aim of this present work is to develop thermosyphon solar heating system for improving the performance using modified phase change material (PCM) modules. Paraffin wax material is used as PCM for holding the heat energy to attain an effective solar fraction. A detailed stratification experimental analysis for heat energy accumulation tank has been carried out on without PCM, PCM without fins, PCM with ring type fins and spiral fins. An hourly based charging and discharging efficiency are also calculated for the above cases and compared. All the experiments are carried out three times and average values are taken for the analysis. From the results measured experimentally, it is inferred that the discharging time of solar water heating system with cylindrical PCM ring type fins is 3 hours more than without PCM. The discharging time of solar water heating system with cylindrical PCM took 7 hours more than without PCM. The charging energy efficiency of heat energy accumulation tank with cylindrical PCM ring type and PCM in spiral module fins confer better results than cylindrical PCM and without PCM. This shows that the PCM get better stratification time and increase the overall performance of solar water heating system.

Paper No:ATFE#105

Simple Analytical Method for Performance of an Absorber Plate in Flat-Plate Solar Collectors for Two-Dimensional Heat Flow

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Abstract. In this paper, two-dimensional temperature distributions in the absorber plate of a flat-plate solar collector have been determined by an approximate analytical technique. In case of two-dimensional heat flow in the absorber plate under actual boundary conditions, the determination of temperature field using an exact analytical method might not be possible. Alternatively, this temperature field can be evaluated using numerical methods. In the present study, finite difference method has been employed as a numerical tool. However, it is well know that the numerical calculations increase the computational cost. For the ease of calculations, an approximate analytical model has been proposed in the present study and the accuracy of the present analytical method has been checked with the comparison of results obtained between the present analytical and numerical techniques. It can be demonstrated that there is an excellent agreement between two results and the deviation between these two have never exceeded by 5%. Therefore, the present analytical method might have a significant importance for analyzing the performance of an absorber plate in order to avoid difficulties of the numerical solution.

Paper No:ATFE#112

Power Management and Energy Optimization in Hybrid Electric Vehicle-A Review

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Abstract. The continuously depleting reserves of fossil fuel triggered the requirement of vehicles equipped or semi equipped with alternative fuel resources. The dependence on fossil fuels could be reduced using an alternative method. The technology used in the hybrid electric vehicle might play an important role in preserving fossil fuel reserves and the environment simultaneously. A hybrid powertrain transmission utilizes an integrated assembly of renewable and non-renewable energy resources for power generation. It requires an accurate and flexible control system to achieve the required output. Typically, hybrid electric vehicles are furnished with IC engine and electrical storage devices like ultra-capacitors or batteries for power supply. The entire vehicle framework is preoccupied with one comprising of two power sources. This paper gives an overview of hybrid powertrain transmission along with a systematic review of energy optimization (EO) and power management (PM) strategies in terms of fuel consumption and emissions.

Paper No:ATFE#136

Steady State Modeling and Validation of A Thermal Power Plant

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Abstract. In the present work, steady state modellingand validation of a 210 MW sub-critical thermal power plant located in north India using mass, energy, and exergy balance equations. The first and second law efficiency has analyzed for each component. Matlab calculation tool and EES (Engineering Equation Solver) software have used for performing analyses. It is concluded from the result obtained that 277.2 MW (72.50%) of the total energy lost in the condenser as the main equipment wasting energy to the environment followed by boiler with 101.4 MW (26.52%) in the cycle. On the other hand, the maximum exergy destruction is seen to be in the boiler system 274.48 MW (85.64%) followed by the other components.The calculated thermal efficiency and the exergy efficiency of the overall plant found to be 36.60% and 35% .

Paper No:ATFE#149

Thermodynamic Analysis of Biomass Gasification Based Power Generation System Through Indirectly Heated GT and S-CO2 Cycle

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Abstract. The study emphasizes on the modeling and thermodynamic performance prediction of a novel biomass gasification based combined cycle plant. It consists of a topping indirectly heated topping gas turbine (GT) cycle and a bottoming supercritical CO2 (S-CO2) cycle for combined power generation. Saw dust is considered as the driving fuel of the plant, which is gasified in a downdraft gasifier and thus the derived producer gas is further burnt in a combustor-heat exchanger combined (CHX) unit. The CHX unit indirectly heat-up the working medium (air) of the topping GT cycle and the CHX exhaust is further utilized in the bottoming S-CO2 cycle to produce electricity in a combined manner. Simulated performance of the plant is judged over wide ranges of considered pressure ratio (rp) and the gas turbine inlet temperature (TIT). The rp value is varied between 4-16 and the TIT is varied between 900-1100 oC. Overall electrical efficiency of the plant is about 46% at rp= 4 and TIT=1000 oC. At the same thermodynamic state points, calculated value of required biomass input is 0.017 kg/s and also the combined net output from the plant is about 140 kW. Overall electrical efficiency value increases with increase in rp value, for all GT TITs as well as hot end temperature difference (HETD) of the CHX unit.

Paper No:ATFE#150

Energetic and Exergetic Analyses of a Solid Oxide Fuel Cell (SOFC) Module Coupled with an Organic Rankine Cycle

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Abstract. In this article, energetic and exergetic analyses of a natural gas fuelled solid oxide fuel cell (SOFC) and organic Rankine cycle (ORC) integrated power generation system is presented. In the topping SOFC cycle of the proposed power generation system, anode channel as well as cathode channel recirculation have been done. Toluene has been used as a working fluid in the ORC. Influence of major operating and design parameters viz. current density of SOFC, cell temperature on the performance of the proposed system have been examined. Results show that maximum energetic and exergtic efficiency of the proposed power generation are found to be 67.06% and 58.17% respectively.

Paper No:ATFE#169

To Reduce Pollution Due To Burning Of Coal in Thermal Power Plant

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Abstract. Over the past decades many techniques or resources are used in order to generate electricity or to produce power and many more. To generate electricity or power some substance needs to be burned those sources include fuels and coals. Coals are the major sources which are used in thermal power industries. And due to the burning of such fuel or coal the production of harmful gases arises. These gases include Co2, sulphur, nitrogen and soot particles. According to various researches the production of Co2 is much larger than the production of other elements which mostly affects the global warming. This project has a new concept which aims to reduce most of those gases which comes out of the thermal power plant. An experimental study has been conducted to check the amount of pollutants coming out from our prototype and on the basis of the results the amount of pollutants reduction will be calculated. This project mainly focuses to reduce the particulate matter coming out of the power plant. Since by burning of a coal the production of particulate matter is much higher that's why this paper aims to reduce that Co2 from entering into the atmosphere and hence reducing pollution as well as the ozone layer depletion.

Paper No:ATFE#177

Ultra-Fast Cooling of Flat Metal Pate in A Modified Runout Table

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Abstract. Cooling of metal components at the end of steel production process is a highly critical step in production. The cooling process rate is time critical and it helps determine various crucial steel properties. There is continuing research which is being done to help improve the process to boost the quality of steel produced as well as reduce the overall cost of production. Ultra-fast cooling involves the use of varied water and air pressures as the cooling media. Surface heat flux at each experimental condition was computed from the transient temperature history measured by K-type thermocouples embedded at bottom surface of the plate. The maximum surface heat flux of 2953.7 kW/m2 was achieved at an inlet water pressure of 5 bar, air pressure of 3 bar, strip velocity of 5 cm/s and nozzle height of 100 mm for an initial temperature of 850 ^{0}C of the 4 mm steel plate.

Paper No:ATFE#181

Cooling of Solar Photovoltaic Cell: Using Novel Technique

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Abstract. Over the past few decades, the world has started moving towards renewable resources of energy from non-renewable resources for meeting todays energy demand. The solar energy is available abundant in nature and easy to harvest it, provides a natural solution to move ahead in fulfilling the energy requirement. The solar photovoltaic cells convert solar energy to electrical energy. In general the regular PV module cell converts nearly about 5-18% of the incidental solar radiation into electricity, and in order to maintain energy balance nearly 60% of incidental radiations are converted in the form of heat energy and with scientific and experimental analysis it is already pre-determined that with increase in internal PV cell temperature there is an exponential decrease in electrical efficiency of the solar Cell gradually with this alternating cooling and super heating process over a time period thermal stresses are formed in Solar Cell which eventually degrades the cell. A practical way of marginally increasing the output efficiency of solar PV Cell is to decrease the operating and surrounding temperature of Solar PV, which can be achieved by maintaining a stipulated temperature when Solar Photovoltaic cell is in operation. Therefore, in the following work a novel passive technique of cooling is been introduced by basic principles of evaporation using sand dunes concept of cooling and will be investigated experimentally.

Paper No:ATFE#191

Numerical Investigation of Single Gas Bubble Rising in Liquid Column

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Abstract. Analysis of bubble fluid dynamics forms the primary step to evaluate heat/mass transport phenomena encountered from rising bubble in liquid pool. Bubble rise in pools of Fast Reactor (FR) finds important applications in source term evaluation, purification of cover gas and air cleaning efficiency of submerged wet scrubbers. In this study inter Foam module available in Open FOAM numerically investigates bubble rise in liquid pool. The FVM solver solves transient conservation equations and phase interface is bounded using MULES. Verification of inter Foam module is done for 2 and 3-D benchmarks available in literature. Bubble behaviour has been simulated for 5 mm bubble rise in sodium for both 2 and 3-D cases. The 3-D bubble case is validated with data available from literature for velocity. The study shows that terminal velocity changes with domain dimension and 3-D case predicts realistic velocity values. The bubble rise investigation is useful for safety studies related to FRs. .

Paper No:ATFE#208

Experimental Investigation of Forced Convection on Square Micro Pin Fins

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Abstract. An investigation is to be conducted to determine whether micro pin fin can increase heat transfer under forced convections or not. This would be accomplished by performing an experimental investigation. In the present analysis thermal effectiveness of square micro pin fin arrays under forced convection conditions in air were studied. Square micro pin fins of different sizes are tested for three different heat loads and it was observed that heat transfer performance of stainless steel micro pin fins were enhanced 5-15% compared with flat plate fins. Further, increase in the overall Nusselt number of the surface was found due to boundary layer regeneration and enhanced flow mixing. In addition, heat transfer effectivity and thermal resistances were decreases with the increase of Reynolds numbers.

Paper No:ATFE#213

Natural Convection Heat Transfer Enhancement Using Cooling Pipes in the Heat Generating Debris Bed

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Abstract. The whole core meltdown scenario is considered as a beyond design basis accident with a probability of occurrence less than 10-6per reactor year. To prevent and mitigate such a hypothetical severe accident, in Fast breeder reactors, research has been focused on accommodating the destroyed core debris within the primary containment boundary. An in-vessel core catcher is provided to receive the fuel debris arising out of core meltdown and disperses it uniformly, thus enabling safe and adequate heat transfer by natural convection. The present study is focused on the thermal hydraulic analysis of in-vessel core catcher. A 3-D numerical analysis has been carried out in the lower plenum of the fast reactor. Turbulence is modeled using the standard k-ε turbulent model. The boussinesq approximation is assumed for liquid sodium. The heat source is assumed to have spread on the heat shield plate and has a total volume of 5.12 m3 with inbuilt decay heat source. The mathematical model is validated with the available benchmark experimental results in the literature. The existing design of core catcher plate is modified by providing cooling pipes in the top collection plate with different configurations to assess the cooling capability of the debris by natural convection. The temperature and velocity contour are obtained to observe the flow field established above the heat source in the sodium pool. It has been found that new design of core catcher improves the natural circulation of sodium toward the center of CC and more than 50°C temperature decrement is observed in upper heat shield plate.

Paper No:ATFE#218

A Novel System to Reduce the Harmful Emission from Diesel Engine by using Electrochemical Technique

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Abstract Inthisresearch, anexperimental setup was fabricated, and the new device was designed in conjugation with the catalytic converter. This pape risconcerned to enhance the efficiency of the exhaust control system by using electro chemical principle. It relates to the use of a solid electrolyte to convert the NOx into N2O and O2. A Freezer Gel pack along with the thermocouple is used on the exhaust pipe to maintain the temperature of the reaction. At a temperature range of 200˚C - 300˚C, N2O is further reduced to N2 and O2, while the oxidation of HC, CO and elemental carbon is done in the catalytic converter. Carbon dioxide (CO2) produced is allowed to pass through normal water in an aluminium alloy chamber. Also, particulate matter is treated in a meshed filter downstream to the aluminium chamber. The result shows a significant reduction in NOxemission.

Paper No:ATFE#231

Effect of Shallow Dimple on Cylindrical Surface for Heat Transfer and Pressure Penalty

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Abstract. Effect of shallow dimples on convective heat transfer from cylinder surface is investigated numerically. Relative assessment of circular cylinder and cylinder with shallow dimple on full surface of cylinder and shallow dimple only on downstream surface of cylinder are done for heat transfer and pressure penalty. Two dimensional numerical investigations are performed for air with velocity in the range of 1 m/s to 5 m/s. Turbulence is modeled using RSTM closer model. The comparison of heat transfer rate for all the reported cases reveal that inclusion of shallow dimple on circular cylinder enhances heat transfer rate. Heat transfer rate augments by 20% in case of full shallow dimple surface compared to plain cylindrical surface. In case of dimple on downstream surface of cylinder heat transfer is 10% more than plain surface. Cylinder with shallow dimple downstream out performs in terms of heat transfer rate and pressure penalty.

Paper No:ATFE#237

Numerical Investigation of Two Dimensional Laminar Flow Past Various Oscillating Cylinder

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Abstract. Two-dimensional laminar flow over oscillating cylinder is analyzed numerically. Three different cylinder shapes namely circular, square and ellipse are considered for analysis. Cylinder shapes are set to oscillate at frequency ranged such that frequency ratio (oscillating frequency/natural vortex shedding frequency, fr) varies between 0.8 to 1.2. The oscillation amplitude is varied between 30% to 50% of the cylinder diameter at fixed Reynolds number of 185. Numerical study is carried out using dynamic mesh features of commercial code FLUENT. Simple harmonic motion to cylinder is applied using User Defined Function (UDF) facility of FLUENT. The formation of anticlockwise or clockwise motion vortices from surface of cylinder depend upon geometrical shape of cylinder as well as frequency ratio of oscillation at extreme positive displacement of cylinder. Wake pattern mode behind the surface of cylinder is 2S mode or 2P mode. Elliptical cylinder outperform square and circular cylinder in terms of drag and lift characteristics. The range of time averaged drag coefficient is lowest. Drag and lift increase linearly for all amplitude and frequency ratio in elliptical cylinder compared to square and circular cylinder.

Paper No:ATFE#248

Compact Solar Air Heater: A Review

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Abstract. In this review work a theoretical study of solar air heater is carried out by considering compact heat exchanger criteria into account. Present investigation comprises different performance parameters for a compact solar air heater. In this review work, Reynolds number is the only variable parameter varies from 4000-18000.Stanton number (St),Stanton number ratio(St/St0), Colburn factor (j) and area goodness factor (j/f) are considered as performance parameters. Stanton number ratio(St/St0) is maximum for multi V-shape rib with gaps. Colburn factor (j) value is highest for multi V-Shaped ribs with gaps. In present investigation goodness factor (j/f)is highest for circular protrusions organized in angular arc form. This study is beneficial for the researchers to conduct the experimental and theoretical investigation in order to search out the new roughness geometries to design compact solar air heater.

Paper No:ATFE#253

Conventional and Advanced Exergy Analysis of Air-Film Blade Cooled Gas Turbine Cycle

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Abstract. Air-film blade cooling is widely used gas turbines blade cooling technique. The present paper carries out conventional as well as advanced exergy analysis of air-film blade cooled gas turbine cycle based on a film-cooling model which takes into account the effect of radiative heat transfer from hot combustion gases to gas turbine blade surface. From the basics concept of thermodynamics it is well known that rise in temperature at which heat is added in a cycle, results in increase in thermal efficiency. This could be possible by increasing turbine inlet temperature (TIT) for a fixed maximum allowable blade temperature. The study further analyses air-film blade cooled gas turbine cycle thermodynamically and further carries out conventional and advanced exergy analysis. The study shows that component-wise exergetic efficiency has been observed as 97.5%, 80.2% and 91.4% for AC, CC and GT respectively while exergy efficiency for gas turbine cycle is observed to be 37.43%. The maximum exergy destruction has been observed for CC ~251.5kW. The results of advanced exergy analysis show that most of the exergy destruction within cycle components is endogenous. This is the indicative of weak mutual interactions between cycle components. The study further shows that ~ 81.2% of exergy destruction for cycle is unavoidable which indicates least improvement potential for cycle.

Paper No:ATFE#254

Effect of Area Ratio on Flow Separation in Annular Diffuser

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Abstract. Annular diffusers are integral component of the axial flow compressor, combustion chambers and inlet portion of jet engine. In present study to predict flow behavior inside the parallel hub and diverging casing annular diffuser having area ratio 2 to 4 with help of FLUENT. The effect of different inlet swirl angles 0°, 7.5°, 12°, 17° and 25° has been studied to predict the reversal of flow and separation of flow from the wall. The analysis of result shows that swirl enhances the pressure recovery up to a particular swirl angle and falls thereafter and also helps in suppressing the flow separation. The effect of inlet swirl on the pressure recovery coefficient has also been figured out.

Paper No:ATFE#267

Highly confined flow past a stationary square cylinder

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Abstract. Present work explores a numerical study based on Finite-Element Method for fluid flow past a stationary square cylinder placed symmetrically in the channel with high Blockage, B = 0.9. Reynolds Number (Re) progressively varied from 5 to 150 in the laminar region. An attention has been paid to capture the exact point of laminar flow separation on the surface of the cylinder and the separation Re for high blockage flow. The steady to unsteady flow transition is observed at a Re (Rec) of 62. A very high drag coefficient, order of magnitude = 103 is reported for the computation. Inconsistency with unbounded flow solutions, the wake bubble for 90% blockage cylinder shows nonlinear variation with Re in the steady flow regime. In a very narrow regime near the beginning of unsteadiness, the flow is found to be quasi-periodic whereas, for all remaining Reynolds number values considered for the present study, periodic flow is observed.

Paper No:ATFE#269

Recent Developments in Finding Laminar Burning Velocity by Heat Flux Method: A Review

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Abstract. This paper reviews the recent developments in heat flux method to determine the laminar burning velocity of a liquid or a gaseous fuel. Laminar burning velocity is an elementary property in designing the combustion chamber, turbulent combustion model and to validate kinetic simulation. There are numerous methods to find the laminar burning velocity such as Bunsen burner method, Flat flame burner method, Counter flow method, Soap bubble technique, Tube propagating technique and Heat flux method. In this paper, some of these methods are discussed in brief and recent developments of heat flux method have been elaborated, as this method is simple and accurate. To find out laminar adiabatic burning velocity there are two requirements to be satisfied. First is, the flame should be one-dimensional, thus flat and stretchless, second is, adiabatic which means net heat exchange with the burner is zero. But, satisfying both these conditions at the same time is very difficult. The other methods have failed in satisfying both the conditions. However, heat flux method proved to satisfy these conditions. Results of laminar burning velocity using heat flux technique for methane-air has been compared with other methods of finding laminar burning velocity.

Paper No:ATFE#270

Identification and Inquisition of Thermoelectric Generator Unit for Efficient Waste Heat Recovery

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Abstract.A Peltier device or Thermoelectric Generator is a solid-state semiconductor device which works on the principle of thermoelectric effect or Seebeck Effect and have an inherent capability to convert heat flux directly into an EMF. Thermoelectric effect which is a result of having a physical contact between two dissimilar conductors with the presence of temperature difference across its ends is further enhanced by effective use of semiconductor materials for its fabrication. Its potential to harness low-grade waste has attracted a lot of attention of various researchers worldwide. But, its continuous and consistent dependence on temperature difference across its surfaces, which is difficult to maintain for a longer period of time has posed various challenges as well. Early experiments indicated possibility of heat leakages within the module itself, which could have been causing drop in temperature difference along with working efficiency. Objective of this experimentation is to identify possibility of heat leakages and its possible effects (if any) on its efficiency. Two different positions were used, for first one heat input surface was upside (hot side up) and second with heat input from below (Hot side down). This change in position will affect the convective motion of trapped air molecules and effect (if any) could be noticed. Results showed that heat transfer rate was more for hot side down with 0.22% more voltage output, 0.44% more power output and 0.521% increment in Seebeck coefficient.

Paper No:ATFE#284

Study of the Flow-Field Inside A Vortex Tube

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Abstract. The focus of this paper/report is the theoretical conceptualization, mathematical modelling, computational analysis, Experimental setup, validation, Programming of the Navier-Stokes equation using the Burger, Laplace, and pressure correction techniques to analyses the flow through the pipe of the vortex tubes. It was approximated by Hilsch, Fulton, Xue et al. that the flow through the hot and cold section occurs due to the bifurcation of the flow somewhere near the middle of the hot end. The physics of the flow inside the vortex tube being a controversial topic as of today, the emphasis has been put to approximate the flow and establish the flow physics. Apart from the detailed hypothesis and the flow physics conceptualization the vortex tube can be used in a variety of areas ranging from the welding applications to the deep space human travel. It is believed by us that the core of the tube observes a free vortex flow, coupled with axial flow from the vortex generator. The periphery of the tube is subjected to forced vortex flow and highly swirling flow. There are two methods of anlysing the fluid flow properties mathematically, that is by the Lattice Boltzman equations and the Navier-Stokes Equation. Efforts have been made to model the axial flow through the tube core using MATLAB code, and Navier-Stokes equation serves as the best governing equations. Discretization has been performed using upwind and implicit schemes. The boundary conditions were predefined to keep a lower count of errors. Periodic boundary conditions have a specific application throughout the grid generated for this purpose. The grid has been generated over the 2D rectangular geometry (210 points in 'X' and 210 points in 'Y') and suitable grid clustering near the wall and inlet has been adopted for better results. The output flow-field generated is visualized using vectors and the wall phenomena are explicitly comprehended.

Paper No:ATFE#288

Conjugate Natural Convection in A Square Cavity with Zero Wall Thickness

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Abstract. The natural convection in a square enclosure heated and cooled in the horizontal direction was investigated numerically in the Prandtl number 0.7and the Rayleigh number range 103-107. The numerical method relied on the full governing equations for time-dependent flows. The study focused on the detection of inertia sustained fluctuations in the flow field and on the highest Rayleigh number where steady state laminar flows are possible. It was found that the highest Rayleigh number decreases dramatically as the Prandtl number decreases. Nusselt number is increased with increase of Grashof number, conductivity ratio and Prandtl number for all the different boundary conditions. On the contrary is a variation of thickness to cavity ratio has negligible effect on Nusselt number.

Paper No:ATFE#292

Transport Phenomenon Improvement Using Induce Draught in Cold Storage

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Abstract. Air is heat transport medium in cold storage operation and its distribution play a vital role in preservation of agricultural product like fruits and vegetables with desired quality. Thermal behaviors of cold storage system is based on air transport arrangements. Convective heat transfer from stored perishable stuff to cooling system within the chamber is subjected to air flow and its distribution. Transport characteristics can handled with axillary arrangements such as induce draught system. Experimental investigation for impact of induce draught on air transportation, is carried out in a 1/4th reduced scaled model of cold storage (size 6m (l) x 4m (w) x 4m (h)) at HT Lab, MANIT, Bhopal. Air transport velocity was measured at 96 station in the chamber with hot wire anemometer. Measurements indicate supply air approaches rear section of the chamber comparatively at higher velocity with induce draught. Mark able improvement noticed with slotted duct wall which boost air flow velocity by 3 times at mid-sections compare without induce draught. Overall 1.5 times to 3 times better supply air flow velocity observed in the chamber, while return air velocity measured almost double during experiment. Experiment suggest shift of turbulence mixing of air from evaporator side to central zone of the chamber. Better mixing of air can help in fast setting of thermodynamic equilibrium in the chamber. It will leads to homogenous thermal environment which can extend the life of perishable goods with maintaining their quality.

Paper No:ATFE#315

Thermal Performance of Solar Air Heater having Triangular Shaped Hollow Bodies Inside

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Abstract. Today solar energy has emerged as an alternate to the conventional source of energy. Solar air heater is one of the important devices to convert solar energy into heat energy of fluid. Lower efficiency of SAHs is one of the major drawbacks. Hence, researcher in the recent past tried to increase efficiency of SAHs by putting different shapes and arrangement of roughness and baffles on the absorber plate. In this work, triangular shaped hollow bodies are putted inside the solar air heater to improve its efficiency. Due to presence of these bodies turbulence is produced locally and these bodies will work as fins also. This results in increase of heat transfer area and along with this heat transfer coefficient between absorber plate and air is also increased. Loss of pressure is also less. Maximum enhancement in efficiency for case-II with respect to case-I is 8.34 % for the mass flow rate at 0.012 kg/s. Maximum rise in temperature for case-I is 10.2°C whereas for case-II is 13.1°C.CFD simulation results and experimental results obtained have good agreement.

Paper No:ATFE#317

Performance Evaluation of Thermoelectric Refrigerator Based on Natural and Forced Mode of Cooling Processes

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Abstract. The aim of this work is to evaluate the performance of portable thermo-electric refrigerator for vehicles (cars, trucks and buses). Thermoelectric refrigerator is based on the principle of a Peltier effect. TES-12704 thermo-electric module has been used in fabrication and tested. The cooling temperature of fin attached with thermo-electric module inside the refrigerator are measured and compared in natural and forced mode. The thermo-electric refrigerator is advantageous to keep perishable items at low temperature during travelling of the people. The results shows that forced mode of producing cooling effect inside the thermo-electric refrigerator gave better performance as compared to natural mode based thermo-electric refrigerator.

Paper No:ATFE#324

Pool Boiling using Nanofluids: A Review

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Abstract. Nanofluids have found their applications in various fields of heat transfer and their demand in various industries in ever growing. Pool boiling of nanofluids have always been a topic of great interest and research. In past years a lot of experimental work has been done on various nanofluids and base fluid solutions to study about the influence of nanofluids on Critical Heat Flux and Heat Transfer Coefficient. Through these works various factors such as surface roughness, wettability, contact angle and particle deposition have also been studied as how these factors influence CHF. This paper also focuses on the past work and studies done on nanofluid pool boiling comprising of the very existing data.

Paper No:ATFE#331

Effect of Flow Maldistribution on Thermal Performance of Water-Cooled Minichannel Heatsink

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Abstract. Flow maldistribution affects the cooling capacity of a water-cooled minichannel heatsink and cooling capacity of heat sink can be improve by minimizing flow maldistribution. Flow maldistribution depends upon the number of parameters such as flow rate, inlet/outlet position, number of channels etc. This computational study has been performed using ANSYS Fluent 16.0 to investigate the effect of inlet/outlet positions and flow rate to delineate the flow maldistribution in minichannel heat sink. In this study, a minichannel heatsink with 28 numbers of rectangular parallel mini-channels having hydraulic diameter 1.5 mm has been considered. Water and aluminium have been selected as a working fluid and heat sink material respectively. In order to see the effect of inlet/outlet positions on flow maldistribution, four different types of inlet/outlet flow arrangements such as such as I-Type, Z-Type, C-Type and U-Type have been considered. Effect of flow rate on flow maldistribution has been observed for the flow rate ranged from 0.5 LPM to 1 LPM. Based on the results, it is found that flow maldistribution is strongly dependent on inlet/outlet positions and flow rate. Among all the arrangement, U-Type arrangement has small flow maldistribution which implies more uniformity in flow-distribution in parallel minichannels and Z-Type arrangement has non-uniform flow-distribution in parallel minichannels. It is also found that flow maldistribution affect the thermal performance of minichannel heatsink. A heatsink with U-Type flow arrangement has better thermal performance as compare to others arrangement.

Paper No:ATFE#354

Heat Transfer Enhancement in Oblique Finned Channel

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Abstract. In the modernistic day, cooling is one of the predominant challenges of electronic and automobile industry. The demand for faster and smaller devices increases the thermal load and at the same time conventional cooling techniques that use extended surfaces (fins, microchannel, heat sink, heat pipe etc.) reached their limits. Recently Oblique fins heat sink has been found as an alternative to conventional heat sink because of their improved heat transfer performance and marginal increase in pressure drop. The reason behind this improved heat transfer is the breakage of continuous fin into oblique fin which keeps the flow in developing condition. Also the secondary flow through oblique channel diverts a small fraction of flow and enhance mixing. Present paper tries to capitalize the advantage of oblique fin with the benefits of nanofluids by carrying out a detailed numerical simulation. Alumina water nanofluid has been used for numerical analysis using single phase and discrete phase modelling approach through oblique fin microchannel. Conjugate heat transfer between the oblique fin heat sink and nanofluid is computed numerically. Approximately 115% and 145% heat transfer enhancement has been observed in oblique channel compared to rectangular microchannel in single phase modelling and discrete phase modelling respectively.

Paper No:ATFE#361

Dynamics and Control of Thermally Heat Integrated Systems

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Abstract. The most crucial objective in a chemical process is to synthesize/design a robust control structure, which can ensure a safe, smooth and profitable operation within the process, even in case of disturbances. In this work, a plantwide control structure has been synthesized for an example process where Tetrahydrofuran (THF)-Water mixture is separated using an Extractive distillation technique. The process design flow sheet consists of two distillation columns from where THF and water are being recovered at high purities while the entrainer is recovered and recycled as a material recycle stream within the process. Further, two Feed-effluent heat exchangers (FEHE) are used to exchange the heats between the hot and cold streams within the process to provide the heat integration, thus making the process more energy efficient. An improvement of 20.79% in the overall energy requirements has been observed upon applying the heat integration circuit. A plantwide control structure is later synthesized on the base case design and its performance is evaluated for ±10% change in throughput change and ±5% change in composition change. The significant feature of this work is the synthesis of control strategy when the control degree of freedom is lost during the implementation of heat integration circuits. To counter this issue, Hi-Selector control loop is used along with supervisory composition controllers.

Paper No:ATFE#379

Numerical Investigation of Scheffler Concentrator Receiver for Steam Generation Using Phase Change Material

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Abstract. This paper proposes a design of Concentrated Solar Power (CSP) system using a scheffler dish solar concentrator which can be used for steam generation and its applications. Water is used for direct steam generation from the receiver. In the proposed model phase, change material (PCM) is present in between the inner and outer cylinder of the copper receiver. A binary mixture commonly known as Solar salt (60% NaNO3-40% KNO3) is used as PCM for analysis. It helps to get rid of fluctuations due to sudden weather changes. Scheffler solar concentrator of 16 m2 area with fixed focus is used to concentrate the solar radiations to the receiver .The purpose of this study is to see the effects of temperature distribution with and without the PCM and also the rate of steam generation for the system numerically using Finite Element Method. Numerical analysis was performed using Transient thermal analysis module in ANSYS 16.0. Results showed that the proposed design of the cylindrical receiver containing the solar salt enhances the performance of the system.

Paper No:ATFE#397

Augmenting Distillate Output of Single Basin Solar Still using Cement Blocks as Sensible Heat Energy Storage

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Abstract. Solar still is a green energy product. It uses heat energy of the sun to purify muddy or salty water. Single basin passive solar still is the best choice for drinking water prone remote areas. Investigations show its limitation because of its lower performance in terms of distillate output. Several attempts were made by different researchers for improving the performance of conventional solar still. One of the proven methods to enhance the output of solar still is to incorporate sensible heat energy storage material. In this experimental work, an attempt is made to enhance the productivity of the single basin conventional solar still by putting cylindrical cement blocks as a heat storage material in basin water. A comparative study between the modified still (with cement blocks) and conventional still (without cement blocks) of the same size was carried out for the same experimental condition of Jabalpur, India (23° 10' N, 79° 59' E), with different depth of water ranging from 2 to 5 cm. Result recorded indicates that the distillate output depends on the water depth and mass of sensible energy storage material. The maximum yield was obtained for least water depth of 2 cm. The daylight productivity was found enhanced up to 67 % in the modified still as compared to conventional still, while decreased performance is observed in overnight productivity. The overall yield increased by 17 % considering 24 hrs. of output. Uncertainty and error analysis has also been carried out.

Paper No:ATFE#410

¬Thermodynamic Analysis of an Integrated Gasification Fuel Cell-Combined Cycle Power Plant Using Indian Coal

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Abstract.In the present study, a detailed thermodynamic analysis of an Integrated Gasification Fuel Cell-Combined Cycle (IGFC-CC) power plant is carried out wherein gasification technology is coupled with Solid Oxide Fuel Cell (SOFC) with Brayton and Rankine cycles as bottoming cycles. The proposed power plant is modelled and simulated using a computer flowsheet program called 'Cycle-Tempo'. The thermodynamic analysis of the cycle with Indian coal as fuel suggests that the steam at higher temperature coming out from the exit of an anode of the SOFC can be used as a potential source for the endothermic gasification reactions in the gasifier. Steam with a flow rate of about 5.43 kg/s extracted from the anode exhaust of SOFC is supplied to the gasifier. The variations of syngas compositions, H2/CO ratios, heating values of syngas with different Steam Fuel Ratios (SFR) at different gasifier reaction temperatures among three different commercially available gasifiers viz. fixed bed, fluidized bed and entrained flow gasifiers have been presented in the results. With an increase in SFR, it has been observed that the H2 composition in the syngas increases whereas the heating value of the syngas decreases. With an increase in SFR from 0.1 to 0.7 at gasifier reaction temperature of 800°C, H2/CO ratio has increased from 0.613 to 1.707 whereas, at 1300 °C, this ratio has increased from 0.46 to 0.95 since lower temperatures favor steam reforming reaction. The net overall plant energy and exergy efficiencies are observed to be maximum in case of entrained flow gasifier with SFR of 0.7and the values are 46.55% (HHV basis) and 42.65%, respectively. The exergy analysis of the plant indicates that the maximum exergy destruction takes place in the gasifier component with a value of 24.85% suggesting a detailed study for its design optimization.

Paper No:ATFE#412

Computational Analysis of Active and Passive Evacuated Tube Solar Collector

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Abstract. A computational study on active and passive evacuated tube solar collector system is examined in this paper. The paper gives us an understanding of the performance of the ETC system under natural flow as well as forced circulation. Major parameters for useful solar-thermal energy gain by evacuated tube solar collector are tilt angle, mass flow rate and specific heat capacity of working fluid. To make sure that the system receives maximum useful heat gain, the optimum mass flow rate has been analyzed using Ansys-Fluent CFD. Thermal efficiency of active evacuated tube solar collector at optimum mass flow rate is compared with thermal efficiency of passive evacuated tube solar collector.It is observed from the numerical modeling of the evacuated tube solar collector that passive system is more efficient than active system.

Paper No:ATFE#420

CFD Modelling and Experimental Investigation of Bi-Modal Slurry Flow in Horizontal Pipeline and Bends

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Abstract. The effect of flow velocity in straight pipelines with horizontal bends having a pipe diameter 53 mm was experimentally investigated over silica sand and fly ash comprised bi-modal slurry. Silica sand and fly ash at 80:20 ratios with solid concentration 8.82 % by volume was taken for extensive experiments at flow velocity up to 3.56 m/s. Concentration samples are collected from mid-vertical plane at different cross-sections in the downstream side of slurry pipe bend. The effect of the presence of fine particles in narrow sized coarse silica slurry through a 90° horizontal bend has been investigated. It is also observed that with increase in flow velocity the pressure drop decreases. Uniform distribution of solid particles is observed just at the downstream flow of the bend except at bend outlet in case of higher flow velocity. CFD modelling is done using Eulerian two phase model with realizable standard k–epsilon approach in ANSYS FLUENT 15 software. The predicted results for pressure drop and concentration distribution using CFD modelling have fairly correct resemblance with experimental data collected from pilot plant test loop.

Paper No:ATFE#429

Cleanroom Ventilation Design Optimization Using CFD Analysis

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Abstract. Environments of clean rooms have a great impact on the study being performed in the place or the products being produced in the highly ventilated and free-form contaminant room. This study investigates transmission and concentration of contaminants like dust, airborne particles, chemical vapors etc., air flow characteristics like velocity distribution and airflow patterns in a typical clean room with exhaust grills under different configurations using a Computational Fluid Dynamic (CFD) program. Eddy sizes, airflow patterns, and pollutant distributions are solved using Reynolds-averaged Navier – Stokes (RANS) solver while performances of the general ventilation are discussed. Other than that, the factors were simulated in laminar and Large Eddy simulations model as well to optimize the design of inlets and outlets in a clean room which could flush out contaminants and control the problem of unpredicted airflows. The clean room studied in the paper is modeled with the placement machine setup along with an operator. The major inlets for contaminations are any kind of leakage. The exhaust grills were modeled at different locations wrt the exhaust chamber of the machine to study the flow of air within the room. The model was optimized with the aim to maximizing contaminant removal from the room and minimizing its effect on the performance of experiment being performed.

Paper No:ATFE#430

Numerical Study of Tio2 Nanofluid in Multistage Bifurcated Microchannel Subjected To Hotspots

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Abstract. The present study discusses about implementation of multiple passive structures along the flow length using TiO2 nanofluid with 0.1% volume fraction to analyze a multistage bifurcated microchannel. Fully developed laminar flow for different multistage plate configurations is used for the computational study, additionally investigations were done to evaluate pressure drop for Reynolds Number ranging from 250 to 500. Two different heat fluxes have been used; 4000W/cm2 is given for hotspot area and 1000W/cm2 for the entire heat sink. Furthermore, the influence of flow rate on bifurcation stages combined with hotspot is highly investigated. Also, the Pressure drop, temperature distribution and flow streamlines are studied to evaluate cooling performance.

Paper No:ATFE#454

The MHD Based Convection Heat Transfer in A Square Cavity with Rotating Cylinder

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Abstract. The present study investigates the influence of magnetic field on the heat transfer phenomena of rotating cylinder kept in the center of the square cavity. The numerical code for mixed convective flow with Magnetohydrodynamics is developed on the open source CFD platform Open FOAM. The developed solver is capable of simulating steady and unsteady flows on any arbitrary geometry. The center of the cylinder is fixed at the center of the cavity with varying blockage ratio (L/d = 2 and 4). The surface of the cylinder is kept as hot, and the two opposite vertical sides are kept cold, while the top and bottom surface are maintained as thermally insulated. The cylinder is rotated clockwise (ω = 50) and anticlockwise (ω = -50) about its center. The fluid is assumed to be incompressible and electric conducting in nature and the all walls of the cavity is also maintained as electrically insulated. The intensity of magnetic field is varied in terms of Hartmann number (Ha) in the range of Ha = 0 and100 for the fixed Rayleigh number of Ra = 105. The flow and thermal field are analyzed through streamlines, isotherms contours for various Ha and ω (angular rotation). Furthermore, pertinent transport quantities as the Nusselt number is also determined to analyze the influence of magnetic field and angular rotation of the cylinder on the heat transfer. It is observed that the heat transfer and fluid flow behavior is significantly affected by the magnetic field and rotation of the cylinder.

Paper No:ATFE#480

Numerical Simulation of Fluid Flow Inside Nozzle Check Valve

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Abstract. The check valve and non-return valve are specially designed valves for permitting only unidirectional fluid flow and are employed as a measure of safety for protection of expensive equipment such as compressor, rotating parts, feed pump, and discharge reservoir. This crucial significance of nozzle check valve gives rise to its exhaustive and thorough study to meet safety standards and ISA valve specifications. The valve design primarily comprises of generating a converging and diverging fluid flow across the valve's inner geometrical surface by keeping least surface area around the valve disc at fully opened position. To better predict the valve's performance, this paper manifests the numerical simulation of fluid flow in a twelve-inch nozzle check valve and calculates its flow coefficient (Cq). The steady-state 3D Naiver-stokes equations with appropriate boundary conditions are numerically solved using FVM method. The computational domain consists of a 10-D and 7-D length of pipe attached to the inlet and outlet section of the valve respectively, to capture flow development where D is the diameter of pipe. The simulation is carried for incompressible fluid (water) at numerous Reynold numbers (3.1E4 to 9.3E5) and obtained Cq is of 2863 ± 5%. It is found that flow coefficient is only a strong function of the shape of valve.

Paper No:ATFE#509

An Experimental Study on Solar Water Heater Integrated With Phase Change Material

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Abstract. This paper shows the experimental investigation of the thermal performance of solar water heater coupled with Phase Change Material (PCM) cylinder. The cylinder contains PCM and spiral copper tubes and is properly insulated using glass wool on the outer surface. The PCM in the cylinder get charged through hot water during the day, due to the availability of solar radiation. When there is no solar radiation (during the night or during cloudy weather) the PCM discharges and transfers its thermal energy to the cold water and hence raises its temperature. Therefore, this system ensures supply of hot water when there is no solar radiation, without using any conventional form of energy. The testing is done in the laboratory and thermal performance of the solar water heater integrated with PCM cylinder is determined. The thermal performance of the solar water heater at different flow rates, i.e. 0.017 kg/Sec, 0.030 kg/sec and 0.050 kg/sec with PCM cylinder and without PCM cylinder was determined and a comparative analysis is done over a period of time. It was found that heat storing capacity and thermal performance of the solar water heater will be enhanced if it is integrated with latent heat thermal energy storage PCM cylinder and hence ensures energy savings.

Paper No:ATFE#520

A Comparative Study of Pressure Drop Across Square and Hexagonal Structured Ceramic Monoliths Using Computational Fluid Dynamics

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Abstract. Strict emission regulations have made it necessary all over the world for a catalytic converter to have high efficiency. A catalytic converter changes the chemical characteristics of the exhaust gases and thus controls the emission levels of various pollutants. To achieve this, catalytic converters use monoliths. Monoliths are commonly of two material types: metallic or ceramic. The monolith provides a large surface area for the treatment of the gases and it should also maintain low pressure to the engine. There are various parameters that affect the efficiency of a monolith but the most important design parameter for a monolith support is the cell shape. In this paper a comparative study has been made between two ceramic monoliths used in the catalytic converters of diesel engine, one having a square cell shaped honey-comb monolith and another having a hexagonal cell shaped honeycomb monolith. Through computational fluid dynamics, pressure drop across sub grid scale models of both square and hexagonal channels has been predicted using ANSYS 12.0, and the results have been validated experimentally and plotted.

Paper No:ATFE#525

Flow of Ferro-fluid in a circular Tube under the Influence of Magnetic Forces

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Abstract. This study deals with the flow of Ferro-fluid in a circular tube under the influence of a magnetic field. A Ferro-fluid comprises of ferromagnetic particles of small size suspended in a liquid. Magnetic force sets a motion of Ferro particles that causes fluid to move due to drag between fluid and the particles. Magnetic pumping will be useful in enhancing cooling of electronic devices at the expense of small amount of energy leading to the increased life of such devices. An expression is derived for velocity profile in a circular duct. Magnetic field and magnetic force distributions are presented for a colloidal solution of 50 micron iron particles suspended in water. The magnetic pressure induced is found to be significant which causes the drift of the solution.

Paper No:ATFE#534

Thermal & Resistance Analysis of Perforated Fin using CFD

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Abstract. The present paper deals with the study of the heat transfer and friction characteristics under turbulent flow within a perforated fin. Standard computational methods using CFD have been used for creating the flow and heat transfer environment similar to that of experiments done by various researchers. To simulate the turbulent flow regime k-Ɛ turbulence model is selected during the CFD simulation. The results obtained from the simulation for both solid and perforated fin is compared on the basis of fin geometries and effectiveness. The results clearly indicate that the perforation in fin increases heat transfer rate as compared to the solid fin.

Paper No:ATFE#564

Numerical Analysis on Variations of Thermal and Hydrological Properties during Water Flow Through Unsaturated Soil

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Abstract. The flow of water through unsaturated soil is based on extension of Darcy's law. The finite difference techniques are used to solve the model for evaluation of variations of hydrological and thermal variation due to flow of water into the soil. The pedotransfer function for estimating the soil properties are further used as input to simulate the problem domain. The validation of simulated result, based on transient heat conduction equation is carried out. Further, the second order upwind and QUICK method are used to compare the thermal simulated results. The simulations result for variation of moisture content, the matric-potential and hydraulic conductivity with respect to rig linear dimension variation are further presented.

Paper No:ATFE#577

Spray Impingement Heat Transfer Using Nanofluid - Experimental Study

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Abstract. Spray impingement plays a vital role in the cooling process. Spray impingement acts as a cooling media for high heat flux applications. As nanofluids have enhanced thermal properties than base fluids CuO, ZnO, and hybridized CuO and ZnO nanofluids at different volume concentrations were used in this experiment. The nanoparticles were synthesized using high energy ball milling (HEBM) technique at 300 rpm with the ball to powder ratio (BPR) of 10:1. These nanoparticles were characterized by using XRD, SEM, and TEM and were found to be in the range of 30nm. The densities, viscosity, thermal conductivity, the specific heat of the nanofluids were calculated using different models. It was observed that increase in the volume concentration, density, and viscosity of the nanofluid increased. The heat transfer study was carried out on an electrically preheated iron plate of dimensions 100mm x 100mm x 8mm at different temperatures of 2000C, 1500C and 1000C. The cooling rate, the effect of air pressure on cone angle and cooling rate was analyzed. The main sources of uncertainty in the measured data were due to the temperature fluctuations and thermocouple locations. It was observed that the time taken to reach the steady state was faster in nanofluids than normal water.

Paper No:ATFE#578

Experimental and Numerical Study of Heat Transfer in Double Pipe Heat Exchanger Using Al2O3, TiO2 Water Nanofluid

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Abstract. Nanofluid is a two-phase fluid of solid-liquid mixture. Nanofluid provides higher effective thermal conductivity when compared with the base fluid. Thermal properties of heat transfer fluid are one of the important topics of concern for research in heat transfer analysis. In recent years there are stances about the study of agglomeration of two or more nanoparticles in base fluid i.e. hybrid or composite nanofluid and they also have good heat transfer characteristics. In this experiment Al2O3 and TiO2 and hybridized Al2O3, TiO2 nanoparticles were prepared by using high energy ball milling technique. These nanoparticles were characterized by using XRD, SEM, and TEM. It was found that crystalline size 30nm. Polyvinyl alcohol of 3% was used in 1:10 ratio of the mass of the nanoparticle for preparing stable nanofluid. The stability was observed for 32 hours which was good to conduct an experiment. The densities, viscosity, thermal conductivity, the specific heat of the nanofluid were calculated. The overall heat transfer coefficient, logarithmic mean temperature difference, friction factor and effectiveness of the hybrid double pipe heat exchanger using the nanofluid were calculated by NTU method. The data obtained using ANSYS (FLUENT) 18.2 were compared with the experimental result. An optimized volume concentration of the nanofluid was found out to be used as an effective cooling fluid in the hybrid heat exchanger.

Paper No:ATFE#595

Experimental Design Based Analysis on Process Parameters for Head Loss in Pipe Bend

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Abstract. In the present, the parameters responsible for head loss have been optimized by using Taguchi approach. The head loss characteristics in transportation of slurry is function of various parameters like solid concentration, flow velocity and additive proportion. Present investigation is focused to recognize the most influence parameter for the head loss in 90° pipe bend. Several influencing parameters of head loss are optimized with the help of the Taguchi method. L16 array is used for experimental design of process parameters. The S/N ratio for head loss is characterized by using smaller-is-better rule. The solid concentration of slurry was varied from 30-60%(by weight) for flow velocity range of 2-5 m/s. Series of experiments are performed on pilot plant test loop to obtain head loss in pipe bend. Results obtained from experimental design revels that flow velocity is found as a dominating parameter as compared to solid concentration and proportion of additive. Probability plot reveals that the experimental data follows the 95% level of confidence.

Paper No:ATFE#610

Flow Characteristics of Crude Oil with Additive

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Abstract. In present work, flow characteristics of high sulphur crude oil (HSCO) with addition of low sulphur crude oil (LSCO) were studied. LSCO was mixed in high sulphur crude oil in concentration 10 to 15% by volume. The rheological characteristics of the heavy crude oil suspension were determined using ISO certified Rheometer for the range of shear rate varying from 0 to 500 s-1 and temperature range varies from 25–45°C. The rheological characteristics of the HSCO include steady state flow behavior, yield stress and thixotropic characteristic etc. Optical microscopy and Dynamic light scattering was used to analyze the size of wax crystals and crystal size distribution respectively. The average size of wax crystals was 2550 nm for 100% HSCO which further reduced to 350 nm after adding 15% LSCO. HSCO shows the non-Newtonian flow characteristics at low temperature and decreases with increase in temperature. Rheological results of HSCO show that there is a reduction in viscosity with addition of LSCO. The LSCO as additive in HSCO can be beneficial for design of crude oil transportation pipeline.

Paper No:ATFE#616

Calibrating the Performance of Pelton Turbine by Using Helical Penstock

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Abstract. This paper presents a study on the comparative analysis of the penstock used in the micro hydropower plants with the aim of inventing a new design of penstock with the efficiency benefits in the future. The Pelton wheel is designed for 0.000143 m^3/s flow rate with a diameter of penstock 0.75 inch and detailed study is done on the benefits of the new penstock which is helical in shape, for by the helical penstock can also be considered as a replacement of the old conventional penstock which is straight and its design strategies are discussed. It was found that the helical penstock was approximately 22-23% more efficient in the voltage generation with the additional benefits such as saving in the material cost, less land acquisition, less wear and tear of the penstock line due to cavitation etc. This is thus more economical, more viable as it produces more with the same input of water and thus helps in generating more power.

Paper No:ATFE#635

Performance Analysis of an IC Engine Using Methanol, Ethanol and Its Blend With Gasoline and Diesel as A Fuel

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Abstract. lot of research work is being carried out to find a suitable alternate fuel so as to decrease the exhaust emission level and to enhance the power output of an engine. The main objective of this paper is to analysis the performance of an IC engine using alcohol and its blends as a fuel. The alcohols which are reviewed in this paper are methanol and ethanol. It has been observed that as the percentage of alcohol increases with gasoline, exhaust emission level of CO, HC decreases. Due to high octane number of alcohols they can be used at high compression ratio. The low density and low viscosity of alcohols helps in improving the spray characteristics and enhance the air-fuel mixing process in a CI engine. Also, oxygen present in alcohol favorable for complete combustion and increase the thermal efficiency. The study in this paper is based on technical as well as quantitative data available from different research and find out what is the effect of alcohols and its blend on exhaust emission level and effect on various engine performance parameter and the future aspect of alcohol as a fuel.

Paper No:ATFE#647

Heat Transfer and Friction Characteristics of an Artificially Roughened Solar Air Heater

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Abstract. In the present work enhancement of heat carrying rate by developing roughness underside of observer surface in solar air heater, has been investigated. CFD study has been done, to estimate heat flow through convection and friction factor in SAH duct in which equilateral triangular shaped transverse rib roughness is used. Computational results are attained using CFD tool Ansys-Fluent. The computational domain has a width 5 times of height *(W/H =5),* relative roughness height *(e/D)* of 0.042, and vertical projection *(e)* is 1.4 mm. The distance between two consecutive ribs (P/e) and Reynolds numbers *(Re)* are in the range of 7.14-17.86 and 3800-18,000 respectively. The effective range of operating parameters roughness on Nusselt no. (Nu) and Friction factor (f) is observed and the outcome is presented to make a comparison with the smooth duct of a solar air heater. The maximum Value of Nu and f in this present work are attained as 2.94 and 3.27 respectively.

Paper No:ATFE#648

Attic Space Convection Analysis with Full Blown Heat Condition with Different Possible Geometries

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Abstract. An issue with the design optimization of building attic space has been addressed in this paper in an artistic manner with the consideration of full-blown condition. Different values for the ratio (0 to 1) of the roof and the floor length in the rectangular cavity has been considered. It includes triangular, rectangular and trapezoidal shaped enclosure. For finding the optimized shape, the study has included the consideration of different values for the Rayleigh number 10^4 to 10^6. The assumption of uniform temperature over the wall and no-slip condition is considered. Isotherm and streamlines are computed to observe the temperature distribution and fluidity of laminar air at Prandlt number 0.71. With the use of ANSYS 18.1, the present study finds the ratio of roof and floor of an attic space to be in between of 0.8-0.9 for best thermal performance.

Paper No:ATFE#660

Novel Dryer cum Grinding Unit: A Thermal Analysis of Herbs Drying

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Abstract. The herbs are being extensively used in Indian families as medical purpose in dried state. Many a time it is open sun dried or control oven dried. But, open sun drying is unhygienic and inefficient process for herb drying. Further, the aroma of the herbs is get compromised at times in control oven drying. The present work discusses the herb drying process cum grinding in controlled sun drying with persevering the aroma and quality of the herb to be dried. The study shows the effect of collector area exposed to sunshine and the useful heat gain at collector end and in the drying chamber, further the instantaneous thermal efficiency is evaluated. The various heat losses in the cabinet and their effect on the system efficiency are calculated. The area of collector exposed to sunshine (A_c) (ranging from 0.6 to 1 m^2) for the study. The maximum thermal efficiency obtained is around 85.22%. It is observed that at lower temperature difference i.e. at 5°C the instantaneous thermal efficiency is higher as compared to the 7°C. Further, total 246 Watts-hr is sufficient for grinding 20 kg dried herbs leaves. This study helps to find out the optimum conditions at which the drying process needs to be performed which would result in improved dryer performance.

Paper No:ATFE#663

An Analysis of a Duct with Different Vortex Generators for Performance Enhancement of a Solar Air Heater: Computational Fluid Dynamics (CFD)

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Abstract. A two-dimensional Computational Fluid Dynamics (CFD) analysis of the artificially roughened solar air heater rectangular duct with three different types of vortex generators (rectangular, triangular and circular) on the absorber plate is conducted in order to increase the transfer of heat in the flow. ANSYS FLUENT 16.0 is used as a solver to determine the nature of flow in the solar air heater duct having vortex generators using finite element method with the SIMPLE algorithm as a base. The variation of average Nusselt number was investigated with the change in Reynolds number ranging from 3800-18000 and with the constant heat flux of 1100 W/m2. The research has found that the average Nusselt number was considerably increased with every range of Reynolds number in all the geometries but most significantly increased in triangular vortex generator with negligible pressure drop. The value of average Nusselt number found in triangular vortex generator at Reynolds number 18000 was 3.848 times to that of average Nusselt number of the smooth duct at same Reynolds number. The thermo-hydraulic performance and enhancement ratio of Nusselt Number is also studied and found to be the best for the duct with triangular vortex generator at Reynolds number 3800.

Paper No:ATFE#666

Investigating the Effect of Geometry on Micro-Channel Heat Exchangers Using CFD Analysis

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Abstract. Micro- Channel Heat Exchangers (MCHE) is compact and robust heat exchangers with high surface area per unit volume facilitating closer temperature of approach. MCHE is conventionally fabricated using photochemical etching followed by diffusion bonding (PCED). Though PCED allows various flow path designs for improved heat exchange, it not deployed for MCHE with cross-sections other than semi-circular. Laser Additive Manufacturing (LAM) can overcome this limitation. The present study is focused on thermo-hydraulic simulation of LAM built MCHE with various cross-sections. A 3D steady-state Computational Fluid Dynamics (CFD) based analysis is performed using CFD code ANSYS CFX to estimate the temperature, pressure drop and velocity distribution across the length of channel and variation of friction factor with Reynolds Number. The working fluid is supercritical Helium and material of construction of MCHE is Inconel 617 (IN 617). The temperature dependent thermo-physical properties of Helium and IN 617 are taken into account for the above simulation. To validate the simulation output, the results for conventionally fabricated PCHE is compared with that of previously published results and are found to be within 5%. The study of MCHE with cross-sections other than semi-circular (i.e., square and circular) is also done using the same CFD code. From this numerical analysis, it is found that the heat transfer is maximum in square geometry while pressure drops, velocity across the channel and friction factor are the least for square geometry.

Paper No:ATFE#674

Experimental Investigation on a Solar Thermal Energy Packed Bed Sensible Heat Storage Combined With Latent Heat Storage

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Abstract. The thermal energy storage is required to store the solar energy, which can be stored by using sensible, latent and thermo-chemical heat storage energy systems. The sensible heat storage is more reliable and full-fledged technology, but it is low efficient due to low heat storage density. In present study, experimental setup is developed by combining the sensible heat storage with a latent heat storage unit in order to store the solar energy. The developed thermal energy storage unit contains insulated cylindrical tank and having hollow spherical capsules of HDPE (filled with fatty acid which has phase change property). The water and oil liquid transport medium is used as a heat carrying substance which works as a transporting heat energy from high temperature container to TES tank and act as SHS materials. The temperature of transport medium is maintained constant at inlet of the tank during charging and discharging process. The effect of flow rate and inlet temperature of HTF is analyzed on charging time with the help of charging experiments. The performance parameters viz. cumulative heat stored, and efficiency is analyzed during charging and discharging processes. The result shows that efficiency of the system with water as HTF is more than that of oil.

Paper No:ATFE#692

Development of Air Intake Manifold Using Alternate Materials by CFD Analysis

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Abstract. Vehicle with high speed is in demand these days. This results in various type of high stresses in multiple vehicular components which may ultimately lead to engine failure and loss in fuel economy. Following the demand, the main objective of the present paper is to increase the performance and volumetric efficiency of the engine by using the light weight alternate material. However, in order to bring the advantages of alternate material into play, many issues including static burst, noise and vibration needs to be settled in its design and development phase itself. The temperature mapping is carried out for Air Intake Manifold and Air duct to ensure that they withstand the temperature. Moreover the flow analysis with respect to the mass flow rate of Exhaust Gas Recirculation (EGR) is done followed by vibration measurement for alternate material Polyamide 6 with Glass Fibre of 30%. Of all the above the greatest challenge the paper investigates vests with achieving the volumetric efficiency of the engine similar or better to that of the aluminum manifold. To maintain or improve the volumetric efficiency, the plenum and runner volume are to be considered in such a way the actual charge of air entering the cylinder through manifold are more effective and smooth.

Paper No:ATFE#697

Numerical Simulation of Cold Flow Analysis of Internal Combustion Engine with Double Lobed Piston Head

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Abstract. The demand for cost-effective eco-friendly automobiles is increasing day by day because of its impact on reducing air pollution. We can't compromise with the usage of automobiles and its advancements as it is inevitable for the development. The only way to combat the problem of air pollution is the reduction of the harmful emissions and it can be achieved by introducing new innovative engine designs which can give a complete combustion. This paper proposes a new double-lobed piston head design which can give better in-cylinder air flow patterns (Tumble and Swirl), turbulence and air-fuel mixing for an IC engine and thereby result in complete combustion. The in-cylinder airflow patterns developed during the intake stroke and the compression stroke of this newly designed IC engine were analyzed and compared with that of conventional flat piston head engine using the numerical simulation of Cold flow analysis. No change in tumble was observed which means the piston head configuration has a negligible effect on the tumble. But there is a 66.67% increase in swirl during intake stroke and 91.47% increase during the compression stroke. This increased swirl creates high turbulence and thereby increasing the engine's combustion efficiency. These results proved the efficiency of the double-lobed piston head configuration in providing better engine performance and thereby reducing the air pollution.

Paper No:ATFE#701

Optimization of Electrical Power of Solar Cell of Photovoltaic Module for a Given Peak Power and Photovoltaic Module Area

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Abstract. In this communication, an attempt has been made to optimize maximum electrical power (i) for a given number of solar cells by varying area of photovoltaic (PV) module and (ii) for a given PV module area by varying number of solar cell. Analytical expressions for solar cell temperature and electrical efficiency of solar cell have also been derived for opaque and semi-transparent PV module. Numerical computations have been made for New Delhi climatic conditions with the help of MATLAB R2015a. Based on numerical computation, it has been observed that (i) an electrical efficiency is maximum for higher PV module area with lower packing factor for a given peak power of PV module (75Wp) and (ii) an electrical efficiency is lower with maximum packing factor for a given PV module area (2.1 m2). Further, an effect of different solar cell materials (i.e. m-Si, p-Si, a-Si, CdTe, CIGS and HIT) on electrical power has also been investigated. It is found that electrical power output for m-Si and HIT are better than other solar cell material PV module.

Paper No:ATFE#705

Vortexing Behaviour During Draining of a Liquid Through Two Unequally Eccentric Drain Ports In Cylindrical Tanks

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Abstract. This paper presents the results of an experimental study on the vortexing behaviour during draining of a liquid (water at room temperature) from a cylindrical tank of inner diameter D=96mm through two circular drain ports (d1 and d2) placed at unequal eccentricities (e1 and e2) from the tank center. e2 is fixed as 42mm whereas e1 is varied giving e1/e2 ratios of 0, 0.25, 0.5and 0.75.After imparting an initial rotation (N rpm),the liquid is drained from the cylindrical tank .The critical height of vortex formation 'Hc'and the corresponding time of draining were recorded. The results of the present study shows that vortex formation gets completely suppressed at all diameters d1 when e1/e2 = 0.5 and 0.75. Furthermore through flow visualization experiments an upward axial flow (above the drain port) establishment is observed in this study which is thought to influence the dynamics and characteristics of the vortex air core formation. The phenomenon of vortex intermittency is also observed in the cases where vortex formation occurs. This attempt is the first of its kind in the research history of vortex dynamics.

Paper No:ATFE#706

Effect of Temperature and Pressure on the Leakage Flow Characteristics of the Bent axis Hydro-motors- An Experimental Study

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Abstract. This article investigates the steady-state leakage flow (hydraulic oil) characteristics of the bent axis hydro-motor fitted in an in-house fabricated hydrostatic transmission (HST) system. In this respect, two different classifications of the bent axis hydro-motors, fixed displacement and variable displacement type are taken into consideration, which is generally used in Heavy Earth Moving Vehicles. The leakage flow paths in these two selected hydro-motors are studied considering their constructional detail. A mathematical model is established to estimate the leakage flow of the said hydro-motors that accounts the change in viscosity with respect to the operating state variable i.e. absolute temperature and operating pressure; where the coefficient model is obtained from the test data. Using the established model, the leakage flow characteristics of the hydro-motors are obtained at different operating conditions and are verified experimentally. From the study, it is concluded that with the increase in load pressure and temperature of the working system, the leakage flow of the hydro-motors used in the Heavy Earth Moving Vehicles also increases.

Paper No:ATFE#708

Experimental Analysis of Thermal Conductive Properties on Aerogel filled Composite Structure

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Abstract. Aerogels are well known for its ultimate thermal resistive characteristics and its low density i.e. several times less than air. Because of these favorable properties, aerogels are mostly used in thermal insulations. The main drawbacks of these insulations are poor strength and limited operating temperatures. In this paper, an attempt has been made to enhance the strength and broaden the range of operating temperature of the insulation made of silicon aerogel. To acquire these properties, a composite structure filled with silicon aerogel has been proposed and experimentally investigated to evaluate its thermal conductivity at different temperatures and heat flow rates. Results have been compared with empty structure and glass wool filled structure by using plots. From the plots, it was concluded that the structure filled with the aerogel has less thermal conductivity than the other structures and also the percentage change of thermal conductivity was determined at different temperatures with different heat transfer rates.

Paper No:ATFE#710

Effect of Selectively applied Surface Roughness and Wake Splitter Plate on the Aerodynamic Characteristics of a Circular Cylinder

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Abstract. This paper investigates flow over a stationary circular cylinder (diameter, D) with locally applied roughness height, 'k' applied at certain circumferential locations of the cylinder in the presence of a detached wake splitter plate with varying length, L. The numerical simulations are done by using commercial software ANSYS Fluent. This numerical study is conducted at a Reynolds number value of 25,000, $k/\delta = 1.1$ (δ is the boundary layer thickness at a given circumferential location) and $L/D = 0.5, 1, 1.5, 2.0$ at different roughness locations $\alpha = 0°, 9°, 31°, 65°$ and 75°. The results indicate that lift coefficient, drag coefficient and Strouhal number are significantly affected as the L/D ratio increases. Whereas, with the change in the roughness location, the aerodynamic/hydrodynamic characteristics are not notably affected. Longer splitter plate along with roughness application is found to cause two effects (a) considerable reduction in drag coefficient and Strouhal number and (b) considerable increase in the lift coefficient.

Paper No:ATFE#712

Mixing Studies in Turbulent Oxy-Methane Jets with and without Reaction

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Abstract. Interactions of multiple jets have several industrial applications like jet mixing in rocket engine and in combustion chambers. Non-premixed (diffusion) flame is used in many applications owing to its stability. The present study considers three dimensional simulation of three separated Oxy-Methane jets which shows that combustion has a prominent impact on their velocity distribution. The radial distributions of longitudinal velocity at different axial locations have been examined. Comparison has been done on reactive and non-reactive jets. Velocity decay for reactive jets is found to be slower relative to non-reactive jets. Turbulent intensity is higher in non-reactive jets which causes faster spreading. The temperature profile shows that the peak temperature does not exist on the centerline plane but at some offset height from the Oxy-fuel centerline plane. The study has been carried out for different jet inlet temperatures. Increase in inlet temperature of reactant leads to a faster velocity decay.

Paper No:ATFE#740

Combustion Simulation of a Four Stroke Single Cylinder S.I Engine for Reducing Emissions

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Abstract. The requirement to reduce the pollutants from the atmosphere is currently needed and the major part of it is caused by IC engine, so as to reduce such emissions, an analysis is being carried out in Ansys IC engine Fluent model. A design of basic combustion engine with a bowl type piston is modelled and a simulation is carried out in Ansys 17.1 Workbench. Simulation of combustion cycle from IVC to EVO is being simulated and the pollutants evolved during this process is being calculated and tabulated by varying the pressure and temperature accordingly and obtaining the best outcome possible from it. The design of valves, inlet and outlet manifolds and a piston is created which would be further decomposed in the simulation software and chamber is created inside which the pollutants data is collected from. By providing the fuel composition that needs to be injected at 4.50 CA bTDC up to 35.50 CA aBDC as it is a gasoline direct injection engine. Spark at 110 CA bTDC is introduced to make sure whole of the fuel is burnt without any unburnt fuel which may produce soot in the system. The results show a variation when the pressure and the temperature of the intake is varied when compared to that of the intake parameter which has high pressure and temperature. The experimental value of pressure is 101325 Pa (1 atm) and temperature is 300 K is taken as the initial condition values and is being used as ideal value for comparison and determining the best among the results obtained.

Paper No:ATFE#741

Improving thermal efficiency by varying input parameters

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Abstract. The use of automobiles is growing day by day and so does the need to improve efficiency in all stages. Thermal efficiency is a factor that is measured by work done by the heat supplied to it. For improving the efficiency of an S.I engine, the inlet air conditions were altered to support various parameters. Kirloskar Tv-1 variable compression engine was used to run the tests. Using a variable compression engine helps us to alter the compression ratio without stopping the engine by using the tilted cylinder arrangement. The engine can be run easily at variable load as well as rpm. The orifice was modified to equip the alterations and to run the tests. Atmospheric air contains moisture and since this air gets inside the engine, initial test was based on to reduce this moisture content and altering the temperature of the air. Various conditions were taken into consideration on how to vary the inlet air parameters. Various modes were sequenced to test out the efficiency. Test 1 involved humidifying the inlet air. Test 2 involved cooling the inlet air. Test 3 involved de-humidifying the inlet air. Test four involved altering oxygen content in an inlet air and test 5 involved a combination of cooling the inlet air and dehumidifying it. The engine was run at constant load and at variable rpm and test 5 gave optimum results.

Paper No:ATFE#747

Fluid Structure Interaction Simulation: Effect of Endovascular Coiling in Cerebral Aneurysms Considering Anisotropically Deformable Walls

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Abstract. In the present research, we use fluid-structure interaction to study the effect of endovascular coiling in brain aneurysms. We simulate pulsatile flow of blood through a tubular hypothetical bulge filled with a homogenous porous medium; however, the wall mechanical properties of the aneurysm wall are different from that of the non-aneurysmal vascular vessel wall. The numerical simulations were carried out using Open FOAM. The FSI technique has a non-linear material model to represent the ICA tissue. Fully implicit method of coupling employed, ensured that the solid and the fluid domain attained convergence at each of the time steps. The results from the FSI simulations show that the presence of a coil in an aneurysm sac reduces fluid loading within the sac and hence the velocity of blood flow becomes negligible within the aneurysm. The Von-Mises stresses and the wall shear stress values on the wall of the aneurysm decrease to a great extent after the coil is inserted. Consequently, the displacement of the blood vessel's wall also decreases, and hence the risk of rupture of the aneurysm reduces. In conclusion, treatment using endovascular coiling technique delays further disintegration of the blood vessel and hence proves to be an effective treatment technique for cerebral aneurysm.

Paper No:ATFE#754

Applying ECFM Combustion Model to Spark Ignition Engine, Comparison with Experimental Data

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Abstract. In order to increase the efficiency of the engine and reduce emissions, right sizing plays a predominant role. Validation of turbulent combustion in engine environment using numerical tools is even more challenging. For better understanding of the thermodynamic and chemical behavior of gas, a proper CFD models setup should be used to represent turbulence, heat model, ignition, flame propagation and knock. This paper presents an application of ECFM (Extended Coherent Flame Model) as a combustion model coupled with ISSIM (Imposed Stretch Spark Ignition Model) to create the flame kernel due to spark. Two mechanisms named stretching and wrinkling, affect the development of the flame front. Stretching is a result from turbulent velocity and wrinkling is a result from turbulent length scale. The effect of the ECFM model constant addressing stretching and wrinkling, and the process to fix those parameters are briefed in this paper. The simulation results have showed a very good agreement with the combustion test results of RENAULT Engine in terms of pressure, heat release rate and combustion duration.

Paper No:ATFE#755

Flow Around Curved Plates at Low Subcritical Reynolds Number: Investigation of Wake Characteristics

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Abstract. In this paper, numerical simulation results of flow over flat plate and curved plates at a Reynolds number of 8000 are presented. Drag coefficient and Strouhal number trends are reported at different chord length (CL) to diameter (D) ratios of 0, 6/13, 3/4 and 1 with varying angle of incidence (ranging from α=00-300 in steps 100). The curvature of the plate was adjusted by varying the radius of curvature keeping the chord length fixed at 40mm.The results of this study shows that the aerodynamic characteristics, viz., drag force and Strouhal number are significantly affected by the introduction of curvature and flow angle of incidence (plate orientation). The maximum reduction of drag coefficient obtained is 58% by the introduction of both plate curvature and plate orientation. Further, it is noted that base pressure coefficient complies with the trend of the drag and the maximum flow field vorticity shows an abrupt increase for CL/D beyond 6/13.

Paper No:ATFE#782

Study on Performance Analysis of Earth Air Pipe Heat Exchanger as Passive Cooling and Heating System

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Abstract. The energy demand for the private and business building increments quickly with the population. Over the most recent two decade indicated extreme energy emergency found in creating nations particularly amid summer season. For hot atmosphere nations like India, the use of cooling framework assumes essential part. The traditional mechanical vapor pressure frameworks toward this path are demonstrating effective however in the present situation when the demand of energy is expanding and the supply isn't adequate one should center around the passive cooling techniques or other substitute which can meet necessity at least cost and energy utilization. As the passive cooling not just gives the course of the outside air to keep up the freshness yet in addition keep up the solace at low energy necessity, such a significant number of analysts have been working over these frameworks to discover it as a substitute of Mechanical Vapor Compression (MVC) units. Earth air pipe heat exchanger (EAPHE) can be utilized as a passive cooling and heating framework by using geothermal energy. This paper intends to display the audit on execution ponder and mechanical advancement of EAPHE at various atmosphere condition. Exploratory outcomes demonstrates that normal temperature drop up to 12 to 200 C can be accomplished relies upon atmosphere conditions. Normal pipe length, measurement and air speed inside pipe were discovered 10-100m, .05-0.5m and air speed 2-5m/s separately. These papers additionally recognize the purpose behind non-successful working of the EAPHE and proposed strategies to enhance the effectiveness of the framework to improve cooling of heating impact.

Paper No:ATFE#784

Parametric Investigations and Thermodynamic Optimization of Regenerative Brayton Heat Engine

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Abstract. The modified configuration of regenerated Brayton heat engine along with pressure drop losses in its irreversible mode is thermodynamically investigated and optimized. The definite temperature differential between system/reservoir is the source of external irreversibility and the losses because of rubbing/friction in turbine/compressor, regeneration heat losses and losses due to pressure drop are the internal irreversibilities considered in this analysis. The output power of the cycle is thermodynamically optimized in context with cycle temperature. It is found that regenerative effectiveness plays a vital role in obtaining maximum possible output power and 1st law efficiency predominantly depends on the cold side effectiveness in the system. It is also observed that the thermodynamic performance of proposed system/device is prominently depends on the efficiency of the turbine and consequently less dependent on compressor efficiency. Moreover, the model investigated in this study yields lesser output power/first law efficiency and exactly follows the results/ outcomes presented in the available literature at $\alpha1=\alpha2=1$, which are the pressure recovery coefficients at two ends.

Paper No:ATFE#793

Numerical Investigation of Solar Air Heater Duct with Square Transverse and Inclined Ribs

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Abstract. A numerical study is conducted to investigate the effect of artificial roughness on heat transfer coefficient and pressure loss of air flow through an asymmetrically heated rectangular solar air heater duct with constant heat flux condition on absorber plate. Reynolds number is varied from 3000 to 15000. Artificial roughness in the form of transverse and inclined ribs is applied on the surface of absorber plate. Heat transfer coefficient, friction factor and thermal hydraulic performance parameter (THPP) are calculated for the range of roughness parameters; relative roughness pitch (P/e) from 11 to 25 at constant relative roughness height (e/D) of 0.8. RNG k- ε turbulence model has been selected for CFD simulation. Artificially roughened surface improved heat transfer coefficient at the expense of increased pressure loss of air flow through duct.

Paper No:ATFE#797

Review of Flows Past Arrays of Elliptic and Square Cylinders

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Abstract. The bodies which create the separation of flow for a certain area of their surface are known as bluff bodies. The bluff bodies can have sharp edges or these can also have a continuous surface. Vortex shedding is important phenomena related to bluff bodies which are present in both laminar and turbulent flows. When more than one cylinder or array of cylinders of the various cross-sections is taken, then the results are highly different from the case of flow over one cylinder. Flows past arrays of cylinders of different cross-sectional areas are experienced in numerous engineering relevant. The several cylinders of cross-sectional areas such as of circular, square, ellipse, rectangular, semi-circular etc. can be organized in side-by-side, tandem, or staggered layout. This paper evaluates the prevailing appreciation of the flows past arrays of cylinders with emphasis on the near-wake flow patterns, the transitional wake formation and conduct, Reynolds number influences, and aerodynamic force coefficients. A principal attention is on the major numerical and experimental discourse that has noticeably since the last significant review of this issue. In this paper, a vigorous has been made to review the study of the work of various researchers for flows past arrays of elliptic and square cylinders, which will be helpful to perceive the various gaps in the research for conducting further new research work in this field.

ADVANCES IN ENGINEERING DESIGN

Paper No:AED#12

Design of EGR Cooler for Improving the Effectiveness to Constraint NOx Emission

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Abstract. In diesel motors, it is exceptionally needed to decrease the measure of NOx in the exhaust gas. NOx arrangement is a temperature subordinate marvel and it happens mostly when the temperature in the ignition chamber surpasses 2000 K. In this way, so as that to diminish NOx outflows in the fumes, it is important to keep the top ignition temperatures under control. One effective path for guaranteeing this is by Exhaust Gas Re-flow (EGR). This procedure is for the most part finished by utilizing a heat exchanger in which fumes gas flows inside the tube and coolant flows inside the shell. The exhaust framework decreases the ignition temperature, due to this arrangement of NOx is lessened. ANSYS Fluent is utilized to solve and recreate the stream fields and temperature appropriation of liquids inside the EGR cooler. Four models of EGR coolers were made using SOLIDWORKS. Model-I is a single shell with square helical tubes inside. Model- II is a single shell with circular helical tubes. Model-III and Model-IV have square and circular helical tubes with fins respectively. The inlet conditions were kept constant for all the models and analysis was done to find out the outlet conditions. Of the four models, square helical tubes with fins (Model- III) was found to give the bets optimum results because of the greater surface area and better heat dissipation.

Paper No:AED#45

Enhancing Learning of Kinematics and Fatigue Failure Theories Using CAD Modeler

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Abstract. Mechanical Engineering is the branch of engineering that specializes in the design, production, and uses of machines. The physics of mechanics is widely used in mechanical engineering. Educators make continuous improvements in providing quality education to ensure that mechanical engineering students understand important concepts and develop skills to apply them in practice upon graduation. Engineering software tools are enabling educators to develop innovative new techniques that enhance the learning of many mechanical engineering topics. This paper discusses the use of SolidWorks CAD modeler to develop learning tools that support the understanding of concepts of mechanical engineering topics such as kinematic synthesis, kinematic analysis, and fatigue failure theories. Specifically, three-position synthesis with specified moving pivots of a four-bar mechanism, symmetrical linkage with synthesis of one of its cognates, and 3D fatigue diagram that extends the traditional 2D fatigue diagrams are described. Effective use of sketch, drawing, and solid model tools with the solid modeler are discussed. The productivity of CAD tools in significantly enhancing learning is recognized through the discussion.

Paper No:AED#53

Integrated Topsis-Moora Model for Prioritization of New Bike Selection

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Abstract. Now a days purchasing two wheeler especially bike in this fluctuating market is backbreaker task for the customers due to lots of complex specifications like mileage, style, life span, cost and suspension etc. To tame this problem, we have many techniques available with us like multi criteria decision making (MCDM), fuzzy logic etc. We have used MOORA (Multi-Objective Optimization on the basis of Ratio Analysis) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution and these methods are one of the best techniques among MCDM because it gives best results and it is used by most of the researcher. Using this technique, we find out the best optimal bike from the customer point of view based on their requirements. First time MOORA and TOPSIS methods are used together to solve this type of problem. Main ten attributes were identified through literature review, and discussion with the experts from the Indian automobile industry. Integrated TOPSIS- MOORA approach is proposed for prioritizing alternatives based on four selected attributes. Perusal of literature indicates that these methods have not been applied earlier for selection of new bikes in Indian automobile industry. Six Indian automobile companies were selected for evaluation of this methodology. Results indicate that best optimal bike based on customer requirements. Fuel economy, style, cylinder capacity and cost are top four prioritized factor taken in this study. The findings will be useful for every new customer and all automobile industry.

Paper No:AED#58

Erosion Analysis of Aramid Fiber Epoxy Composite

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Abstract. All the Industries are mostly affected by the financial loss due to Tribology. Especially, when a solid liquid mixture is transported through pipes and pumps, erosion occurs. It is very crucial in tidal turbine blades which on interaction with sea water and slurry undergo large surface erosion. In this work, Kevlar fiber epoxy composite was prepared using VARTM technique and tested for erosion by slurry jet erosion tester. The parameters for erosive wear test were taken as fiber content, impact velocity, slurry concentration, and impingement angle. The fiber content was varied in the range of 52 wt. %, 55 wt. % and 58 wt. %. Analysis of experimental data was done by Taguchi Design of Experiments. The finding of result indicated that the fiber content and impact velocity were most influencing factor affecting erosion rate followed by impingement angle and slurry concentration. Minimum erosion wear rate was obtained at impact angle 60° and impingement velocity 30 m/s.

Paper No:AED#71

Static and Dynamic Characteristics of Two Lobe Hydrostatic Journal Bearing

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Abstract. The behavior of multirecess hydrostatic journal bearings is now very well-known because of stability and many numerical and experimental studies that have been carried out in this area. Noncircular or mutilobe journal bearings are also used in high speed machinery, gas turbines and test equipment's due to their excellent shaft stability characteristics and capability to suppress the whirl. Capillary and orifice are most commonly restrictors for hydrostatic bearings because of simple manufacturing. The two lobe bearings are among the commonly used noncircular journal bearings. The aim of this study deals with the theoretical investigation of a two lobe six recess hydrostatic journal bearing systems to presents static and dynamic performance characteristics with different restrictors such as capillary, orifice etc. and comparison of characteristics of capillary and orifice restrictor. Recent years have witnessed quite a substantial amount of research work in the area of fluid film lubrication. The analysis and design of two lobe six recesses hydrostatic journal bearing is quite a complex process. There are various parameters such as bearing configuration, lobe position, type of restrictor, number of recesses, shape of recesses, lubricant supply pressure, external load, bearing operating and geometric parameters etc., which influences of this class of bearing quite significantly. The analysis of a two lobe multi recesses hydrostatic bearing would become more realistic by incorporating physical effect of method of compensation device. Further, a designer may improve the performance of bearing by varying the number of recess.

Paper No:AED#74

Numerical Simulations of Bore Finishing Tool Lubrication System to Achieve Minimum Quantity Lubrication using Discretized Phase Model

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Abstract. Cooling, as well as lubrication, is essential for almost all types of metal cutting/machining processes. Nowadays the Minimum Quantity Lubrication (MQL) technique has been found very popular and is been used widely during metal cutting/machining over the flood lubrication. In contrast to flood lubrication, minimum quantity lubrication uses only a few drops of lubrication (5ml - 50ml per hour) in machining. Hence, the reduction in the quantity of lubricant compared to the circulated quantities of conventional metal-working fluid systems is the key feature of MQL. However, the supply of the adequate quantity lubrication as well as homogenous (air-oil) mixture is essential to avoid dry-out conditions at machine tool. In this paper, numerical simulation of lubrication system used for bore finishing machine line is presented. The lubrication system uses the minimum quantity lubrication controlled by a distributor system having a common pipe carrying lubricant. This pipe has the multiple outlets (13 outlets) supplying the lubricant at respective 13 boring tool machine. The Discretized Phase Model is used to simulate the continuous medium (air) interacted with injection (oil) particles. Various flow rates, as well as supply (distributor) pressures, are simulated in order to obtain the homogenous distribution of lubricating oil. From the simulation results, it is seen that with inlet distributor pressure of 6 bar, inlet velocity of 39 m/s and with oil injection rate of 50 ml/hr shows the optimum, as well as homogenous air-oil distribution at all 13, lubricant outlets.

Paper No:AED#82

Comprehensive review on hybrid vehicle powertrain

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Abstract. In the automobile sector, the use of a hybrid powertrain is considered one of the essential steps for reducing environmental temperature and pollution. The demand for non-polluted renewable fuel especially for light-duty vehicles continues to increase with economic growth and development of the nation. With regard, the upgrading technology of current hybrid electric vehicles can be considered as progression in this field of developing zero emission. The main purpose of the present work is to compare the functionality of series, parallel and combined hybrid powertrains. This article also explained the favorable and unfavorable areas of all configurations that are usually faced by the owner. The functionality of hybrid powertrain used in the Maruti Suzuki Ciaz is also explained in the article. Hybrid vehicles are far more fuel efficient and emit fewer greenhouse gases as compared to the conventional gasoline light-duty vehicles. The hybridization of vehicles could assist in solving the greenhouse gas emission and global warming. This paper provides a glimpse of the upgraded technology and production capacity of all the hybrid configurations in vehicles. The use of upgraded hybrid technologies in the vehicle not only economical but also environment-friendly. The emission of carbon monoxide (CO), nitrogenous product (NOx) and hydrocarbon (HC) are effectively checked with the vehicle that uses hybrid technology.

Paper No:AED#83

Stress Analysis of Infinite Plate with Elliptical Hole

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Abstract. The Stress field around different geometries like circular, rectangular ,triangular, elliptical having different orientations and loaded with different loading conditions can be find out using methods discovered by several Researchers. One similar attempt have been made to determine the stresses around elliptical hole with infinite plate loaded in X direction and Y direction subsequently. The elastostatic problem of the homogeneous isotropic infinite plate with the loading at infinity (in X and Y direction) for the elliptical hole is considered in this paper. Boundary value problem is solved with Complex stress functions using complex variable Approach For this work, the Schwarz's alternating technique given by Sokolnikoff and Ukadgaonkar is used, the derived analytical solution can be used for generation of code in C++ to find out the stress components at a given particular point.

Paper No:AED#87

Development of Collision Avoidance System using Fuzzy Logic

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Abstract. The collision avoidance system is the present state of art hard-ware/software integration for preventing an impending collision. The developed algorithm functions in two stages. It first warns the driver and if the driver fails to respond in time, it applies the brakes automatically to avoid the collision or reduce its severity. This paper deals with the development of a suitable mathematical model for Collision Avoidance System. Analysis and Simulation of mathematical model has been done in MATLAB®. Simulation studies with On-Off and Fuzzy Logic Controller are compared and usefulness of Fuzzy Inference System (FIS) has been established. With two fuzzy inputs namely (slip ratio and rate of change of slip ratio) and one output (fraction of Brake Pressure required), optimum braking force is achieved. An iterative method is used to optimize the FIS controller. A new definition of critical distance has also been developed for optimization of the assessment of critical distance.

Paper No:AED#94

Flexural Properties of Silver date Palm Leaf Reinforced Polyester Composites

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Abstract. An attempt has been made to fabricate a new composite material by incorporating silver date palm fiber as reinforcement in the polyester resin. The composites have been fabricated up to a maximum volume fraction of fiber about 0.467. The flexural behavior of fabricated composites was investigated as a function of fiber content. It has been observed that the flexural strength of the composite material increases with an increase in fiber content up to 0.26 volume fraction and start decreases with increase in volume fraction of the fiber. It is found that the maximum flexural strength of the composite is 377.69 MPa for the volume fraction 0.26 which is about 1.25 times greater than that of plain polyester resin. This results show that there could exists a solid bond between the fiber and resin at a volume fraction of 0.26. It has been concluded that using silver date palm fiber as reinforcement in plain polyester resin plays a major role in terms of high flexural strength of a new fabricated composite material.

Paper No:AED#96

Tensile Behavior of Silver Date Palm Leaf Reinforced Polyester Composites

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Abstract. In the current study, a light weight composite material has been fabricated using silver date palm tree leaf fiber as reinforcement in polyester resin matrix. The fibers are extracted using retting and manual process. The density of the fiber is found to be 500 Kg/m3. The composites have been fabricated up to a maximum volume fraction of about 0.58. The tensile properties of the composites were investigated as a function of fiber content. It has been observed that the tensile strength of the composite increases with an increase in fiber content up to 0.41 volume fraction and decreases with increase in volume fraction of the fiber. It is found that the maximum tensile strength of the composite is 200.5 MPa for the volume fraction 0.41 which is about 1.67 times greater than that of plain polyester resin. This results show that there could exists a solid goring bond between the fiber and resin at a volume fraction of 0.41. It has been concluded that using silver date palm fiber as reinforcement in plain polyester resin plays a major role in terms of high tensile strength of a new fabricated composite material.

Paper No:AED#104

Experimental Investigations of Multiple Faults in Ball Bearing

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Abstract. Ball bearings are extensively used in many rotating machinery applications. Ball bearing failure is the main cause of breakdown of the rotating machineries. Local defects in ball bearing produced due to fatigue consist of cracks, pits and spalls on the rolling surfaces. Several researchers have studied the single fault in ball bearing, but in practice two or more faults (combined fault) are usually present. Fault diagnosis of a single row ball bearing has been extensively studied, however literature specific to double row ball bearings are sparse. This paper presents such cases, where single and multiple bearing faults of double row ball bearing are considered together. The objective is to experimentally investigate the single and multiple bearing faults of the inner race, outer race, cage and ball fault using envelope analysis. Envelope spectrum analysis is the best tool for bearing fault diagnosis like cracks and spalls in ball bearings. Bearing frequencies are excellently identified in the envelope spectrum.

Paper No:AED#110

Estimation of Plastic Zone at Crack tip under Fatigue Loading of AA6061-T6 Aluminum Alloy by Finite Element Analysis Using ANSYS

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Abstract. The plastic zone shape and size are analytically estimated at crack tip under fatigue loading (at stress ratio (R) = 0.1 and 0.5) of AA6061-T6 aluminium alloy by finite element analysis using ANSYS. The stress intensity factor (SIF) is a measure of the mechanical force required for crack growth and is closely related to the plastic zone formed in the vicinity of the crack tip. The stress intensity factor range (ΔK) was determined by finite element analysis using ANSYS and was compared with the experimental data obtained as per ASTM standard to decide the applicability of the analytical method in the present work. The comparison exhibited that the error to determine SIF using ANSYS is less than 20%, which lie under acceptable range. The finite element analysis was applied to determine the plastic zone shape and size at crack tip using ANSYS. A butterfly type of cyclic plastic zone was observed in the plane strain condition. At lower ΔK, smaller plastic zone was measured for R = 0.5 comparison to R = 0.1. After ΔK = 12.00 MPa√mm, comparatively larger area of plastic zone was observed for R = 0.5. At constant ΔK = 12.88 MPa√mm, the value of maximum SIF (Kmax) was obtained as 14.29 MPa√mm and 16.11 MPa√mm at stress ration (R) = 0.1 and 0.5 respectively. It was also observed that at same Kmax = 16.55 MPa√mm, the value of ΔK is 14.86 and 18.13 for R = 0.1 and 0.5 respectively. The increased value of ΔK results in larger plastic zone for R = 0.5 at later stage of crack growth.

Paper No:AED#116

Shape Optimization of the Flywheel using the Cubic B Spline Curve

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Abstract. This paper presents the shape optimization of the flywheel using uniform cubic B-spline curve. The performance of the flywheel can be evaluated by its energy storing capacity defined as kinetic energy per unit mass. The kinetic energy per unit mass depends on the geometry of flywheel. Therefore, a profile of flywheel is modeled using a uniform cubic B spline parametric modeling method. Then shape optimization model is formulated with the objective of maximizing the kinetic energy per unit mass of the flywheel under the design constraints of the mass of the flywheel and the maximum value of total stress. The y coordinates of control points are taken as design variables which distribute along the radial direction. Then the formulated problem is solved by using Jaya algorithm. The proposed approach is applied to the flywheel of agricultural thresher machine. It is found that the optimized shape of flywheel stores the more energy to the existing shape of the flywheel of thresher machine.

Paper No:AED#121

Numerical Methods to Estimate Fracture Parameters in Ceramics

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Abstract. Ceramic materials are widely used in most of the industries due to their outstanding mechanical properties like high strength, high modulus of elasticity, corrosion resistance, low coefficient of thermal expansion etc. It is therefore vital to understand the deformation and fracture of ceramics to take preventive measures to circumvent catastrophic failure. The deformation process and fracture of ceramics can be understood through fracture mechanics of brittle materials. In the first part of this work, an overview of the fracture mechanics and the various approaches employed to predict the failures of isotropic and homogeneous materials is briefly presented. Following this, a brief overview of the numerical methods used to estimate fracture parameters to analyze the failure of ceramic materials is discussed. Estimation of stress intensity factor of a typical ceramic material used in industry through numerical simulation and the associated result is presented in this work.

Paper No:AED#123

The advancement of united acceleration-brake pedal: A review

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Abstract. In the modern time, vehicles are equipped with the dedicated accelerator and brake control pedals. Right foot is mostly engaged in operating the pedals having contrasting and dissimilar behaviour. To operate a pedal, a driver needs to leave the other. The switching time between the pedals in various situations has been determined by the ability and response time of the driver. Another critical parameter for safety is the time required for the vehicle to stop completely. Switching foot between the pedals takes time, and consequently, the vehicle will travel more distance before stopping. The delay between the shifts from one pedal to the other reduces the effective stop time of the vehicle and leads to serious accident sometimes. In recent years, automobile designers have developed several coupled accelerator-brake pedal systems to reduce the response time in braking and to eliminate the possibility of pressing the incorrect pedal during panic situations. This study aims to summarize and discuss the recent development of combined acceleration-brake pedal and its usefulness for future vehicles.

Paper No:AED#127

Impact Static Analysis of Functionally Graded Plate Using Non-Linear Classical Plate Theory with Von-Karman Strains: A Complex Solution Analysis

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Abstract: The present study is based on the nonlinear bending analysis of Functionally Graded Material (FGM) plate with Von-Karman strain based non-linear classical plate theory with in-plane displacement and moderate rotation subjected to thermal loading in transverse direction. The equations of motion and boundary conditions are obtained using the Principle of Minimum Potential Energy (PMPE) method and material property is graded in thickness direction according to simple power-law distribution in terms of volume fractions of the constituents. The temperature is varying linearly through the thickness while temperature dependent material properties are non-linear function of temperature. The effect of temperature dependent material property is studied. It is observed that dependency of material property on the temperature cannot be neglected for analyzing the in-homogeneous FGM plate subjected to thermo-mechanical loading. The complex solution is obtained using analytical method viz. Navier's Method which assures minimum error in the solution for simply supported plate. The results show that the response is transitional with respect to ceramic and metal and the complex solution predicts the real behavior of stresses and deflections in the FGM plate. The transverse deflection is in-between to that of metal and ceramic rich plates for FGM plates. The complex form of solution also gives information about the stress distribution in the thickness direction. The effect of temperature rise, side-to-thickness ratio and volume fraction exponent on non-dimensional maximum central deflection and axial and transverse shear stresses of an FGM plate is studied.

Paper No:AED#128

Free In-Plane Vibration of a Cracked Curved Beam with Fixed Ends

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Abstract. Curved beam is extensively used in different engineering fields, presence of crack weakens the curved beam and introduces local variation in stiffness. This leads to varying dynamic responses of the beam. Therefore, analysis of dynamic behavior of a cracked curved beam is an important issue in order to identify the crack. Hence, in this paper, the curved beam has been modelled by Timoshenko beam model and in plane free vibration of the cracked curved beam with both end fixed conditions has been numerically studied.

Paper No:AED#133

Electrical Discharge Diamond Grinding (EDDG): A Review

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Abstract. Due to the lower productivity of Electrical discharge machining (EDM) process, it is not widely used for machining purpose. So a new hybrid machining process (HMP) has been discovered namely electrical discharge diamond grinding (EDDG). This EDDG is combination electric discharge machining (EDM) and grinding wheel with metal bonded diamond grit. EDDG gives better performance than EDM due to the spark generation the rotating diamond wheel. This paper aims to summarize the work done by various researchers on EDDG process along with developments in same area. Various output responses such as Wheel Wear Rate (WWR), Surface Roughness (Ra), Average surface roughness (ASR) and Material Removal Rate (MRR) have been analyzed by different researchers considering various factors like pulse current, wheel speed, pulse on time, duty factor, abrasive particle size (APS), infeed, pulse off time and abrasive particle concentration (APC) as input parameters, to compare the performance of the process considering different configurations of EDDG. The study reveals that EDDG can be efficiently used for grinding, super alloys, MMCs, cremates & various combinations of carbide steel. Further it was concluded that online dressing, thermal softening of the workpiece and de-clogging of the wheel are remarkable features of EDDG. This process have a great future scope as it provides us the surface finish in order of few nanometers.

Paper No:AED#138

Detection of Crack and Unbalancing in a Rotor System Using Artificial Neural Network

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Abstract. Crack and Unbalance are two important effects experienced by a rotor system during its motion. These are a common source of high vibration and undesirable functioning in rotating machinery. The methods of detection of rotor faults have improved from time being such as single fault identification at any given instance, but generally more than one fault are existent in a rotor system simultaneously which has not been discussed so far. In this work, a method is being devised to critically identify unbalance and crack in rotor system using Artificial Neural Networks (ANN) by statistical features. Moreover, a Confusion Matrix is also obtained by statistical features. Then, by the help confusion matrix the class of crack and unbalance was decided. Validation and testing of the neural network hasbeen done with simulation data.

Paper No:AED#166

Understanding the Significance of MotorVehicle Window Wiper

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Abstract. The common mode of transport for road commuters is using a motor vehicle. Governmental transportation departments all over the world have laid down specific safety regulations to ensure a safe commute both for the people inside and outside the motor vehicle. Such stringent regulations find practical applications especially in case of adverse weather conditions. For example, in India, most cities experience plentiful rainfall during the monsoons. This poses a threat of increased road accidents owing to the reduced visibility. Automobile OEMs have managed to design and develop windshield wipers which are capable to wipe off rain water and provide an unobstructed front view to the drivers. But safety concerns still remain for the side view. The human eye is trained to pick up visual cues from its extended field of vision. Thus a driver can judge what is approaching from the side even while looking in front. This field of vision is obstructed in case of droplets adhering to the window. Automobile manufacturers have resorted to modify the glass surface to reduce adherents instead of accepting the concept of a side window wiper. In this paper, the desired characteristics of a window wiper will be discussed and thereby its importance clearly outlined. The similarities in criticisms at the advent of windshield wipers in comparison to window wipers will be highlighted. Further, the mechanisms proposed through various patents and commercialized prior arts shall be explained.

Paper No:AED#179

Kinematic Synthesis of a Crossed Four-Bar Steering Linkage for Automobiles

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Abstract.A crossed four bar mechanism has been synthesized in a recent work using Hooke and Jeeves optimization method. The maximum rotation of the outer wheel is forty nine degrees. The track to wheelbase ratio is four-tenth. In the present work kinematic synthesis has been carried out using precision point technique for a benchmark vehicle with track to wheelbase ratio 0.326. There are two design parameters only. The mechanism has two equal links which are the input and output links. The non-dimensional length of these links is one design parameter. The other design parameter is the angle of inclination of these links with the longitudinal axis of the vehicle. Two non-linear equations have been obtained in this synthesis. These are solved using Newton-Raphson method. Five precision points have been obtained with maximum steering error of 0.01 degree. The mechanism needs two equal spur or helical gears to be added to it so that it can produce a coordinated motion of the front wheels. It has been found that the present method is more efficient than the Hooke and Jeeves method since less number of iterations are required by this method.

Paper No:AED#183

Nonlinear Dynamic Response Analysis of Cylindrical Roller Bearings Due to Unbalance

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Abstract. Additive manufacturing is another word for Rapid Prototyping (RP). Rapid Prototyping in its earlier form was done using Stereolithography (a term coined by Chuck Hull in 1984). According to a variety of literature, additive manufacturing (AM) is incontestable to bring about a revolution in the way products are designed, manufactured, and supplied to end users. AM technology has gained significant academic as well as industry interest due to its ability to create complex structures with customizable features and materials. The goal of this review paper is to organize this body of knowledge surrounding AM, and present current barriers, findings, and future prospects for manufacturers & researchers. The evolution due to AM in areas such as material, design, and production also has been discussed.

Paper No:AED#185

Additive Manufacturing & 3D Printing: A Perspective

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Abstract. Additive manufacturing is another word for Rapid Prototyping (RP). Rapid Prototyping in its earlier form was done using Stereolithography (a term coined by Chuck Hull in 1984). According to a variety of literature, additive manufacturing (AM) is incontestable to bring about a revolution in the way products are designed, manufactured, and supplied to end users. AM technology has gained significant academic as well as industry interest due to its ability to create complex structures with customizable features and materials. The goal of this review paper is to organize this body of knowledge surrounding AM, and present current barriers, findings, and future prospects for manufacturers & researchers. The evolution due to AM in areas such as material, design, and production also has been discussed.

Paper No:AED#187

A Comparative Study for Transmission Efficiency of ABS, POM and HDPE Spur Gears

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Abstract. Application of polymer gears is increasing due to some of their inherent properties. Nowadays, polymer gears are replacing metal gears in various applications. They have less weight, lower inertia and run much quieter in comparison to metal gears. In this work, the transmission efficiency of polymer gears running at different speed (600, 800, 1000 and 1200 rpm) and torque (0.8, 1.2, 1.6 and 2 Nm) are studied. Three different thermoplastic materials viz. Acrylonitrile Butadiene Styrene (ABS), Polyoxymethylene (POM) and High-Density Polyethylene (HDPE) are used to fabricate polymer gears using injection molding machine. Gears are operated for 1.2×105 cycles to investigate the transmission efficiency. The experiments are carried out using a power absorption type polymer gear test rig. It is concluded from this work that transmission efficiency of these polymer gears is significantly affected by torque. Speed has less significant effect on transmission efficiency of polymer gears.

Paper No:AED#207

Performance Analysis of Special Design Single Basin Passive Solar Distillation Systems: A Comprehensive Review

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Abstract. Solar desalting systems are used for maintaining the shortage of fresh water in distant areas where sunlight is available in great quantity. These solar stills are working on the principle of evaporation and condensation for generating potable water. These systems are about maintenance free requiring minimum manpower and can be made-up by materials voluntarily available in local market. A variety of designs of single basin passive solar stills are used to enhance the efficiency and rate of fresh distillate output. It helps in fulfilling the existing gap between the demands against the fresh water supply. Guarantee of fresh water availability for the world is an immense challenge. In the present work, various types of specially designed single basin passive solar distillation systems have been reviewed and concluded on behalf of economic, self-sustainable and production rate with some new challenges.

Paper No:AED#227

Modelling, Fabrication and Characterization of Kevlar Reinforced Composite

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Abstract. Fibres are used as reinforcement in the modified epoxy resin matrix. Epoxy resin is modified using polyetherimide (PEI). Content of polyetherimide in epoxy is derived up to 10 wt.%. Mechanical properties improvement is observed around 7.5 wt.% and 5 wt.% of polyetherimide in blended epoxy as compare to pure epoxy.In the present work Kevlar fibre in mat form is first introduced with epoxy resin. Then other samples were made by blending epoxy with different percentage of polyetherimide. Fabricated composites are subjected to various mechanical properties evaluation tests. Results exhibits increase in strength values. Tensile, shear and impact strength is maximum for composite samples having 7.5 wt.% PEI. Flexural strength is maximum for samples with 5 wt. % PEI. DSC and TGA of samples is also done for material characterization of composites. During the TGA testing the degradation of samples in the Nitrogen gas atmosphere two different stages at 250- 350ºC and 450- 600ºC are observed where significant wt. loss has occurred. The DSC analysis of Epoxy resin and PEI blended resin shows two different glass transitions at 90ºC and 220ºC respectively.

Paper No:AED#229

Characterization of Abs Material In Hybrid Composites: A Review

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Abstract. The importance of PC/ABS (Polycarbonate/Acrylonitrile butadiene styrene) alloy is increasing day by day in today's world. In this work we have analyzed and compiled the ABS substrate both qualitatively and quantitatively in various fields like doping, surface modification, polymerization, conductivity and electroplate decomposition. Also, an in-depth overview of the mechanical behavior, thermal properties, metallization and modulus of materials has been investigated here. ABS plates with nickel and copper serves good in industrial applications. Apart from this their widespread applications in automobiles, communication instruments, electrical and electronics equipment, injection molding and fused deposition modeling were studied to analyze the mechanical behavior of virgin ABS because of its user friendly behavior and simplicity for machinery actions. The degeneration of ABS Substrate caused due to less amount of nitrogen obtained from the paralysis of DABS has been discussed thoroughly. Quasi-static mechanical properties of FDM-ABS materials were also taken into account. In order to improve flame retardancy, it was advised to promote char formation using Tin and Zinc based Lewis-acid Salts as charging additives on ABS during combustion. Also, flame retardant properties in ABS were observed by the reaction of hexachlorophosphazene with phenol and catechol. ABS rubber resin and fumed hydrophobic silica nanoparticles were dispersed together to get the best wear abrasion resistant polymer, Taguchi method was introduced to calculate S/N(Signal to Noise) ratio. Later, the study on laser transmission welding of polymer joints by 2 ABS sheets has also been taken into consideration. The emphasis on production of innovative models using ABS waste has been laid. The discussion on the tribological behavior of composites has also been studied. Boiling effects of ABS fraction on glassy transition temperature and strain rate on deformation behavior of PC, ABS alloy are theoretically concluded in this work.

Paper No:AED#242

Formation of Hole Flanges Through Incremental Forming: A Review

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Abstract. Hole-flanges are formed around a hole with pre-cut hole on sheet metal which is used for fixation and guiding cables. The present study presents a critical and concise review on formation of hole-flanges through incremental forming. Aluminum alloys, steel alloys and polymers are used in majority of investigations of hole-flanging through SPIF. Numbers of stages with different tool trajectories are utilized by researchers are found to be efficient as compared to single stage hole-flanging through SPIF. Variety of shapes of tool with hemispherical tool tip, high speed tool and new featuredtool are utilized by researchers for hole-flange forming through incrementalforming. Circle grid analysis found to be handy tool for prediction of formability in terms of forming limiting diagrams (FLD).It is found that through developed experimental set-ups, cost of tooling sets and cycle time have reduced consider ably. Higher formability is attained in hole-flanging through SPIF as compared to conventional press working due to absence of necking .It is found that in majority of investigations, shell and solid elements are used for meshing of sheets in FEM simulation of hole-flanging through incremental forming.

Paper No:AED#258

Modal Analysis of Clutch Plate

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Abstract. Friction clutch is a most basic part during the time spent power transmission. The part of clutch is to start the movement or increment the speed of a body by exchanging motor vitality from another moving body. To maintain a strategic distance from disappointment and to have ideal weight and cost, it is important to discover the stresses and investigate vibration qualities of a clutch. The present paper manages planning and designing a friction clutch get utilizing Solid Works software and its auxiliary analysis by utilizing ANSYS programming. Modal analysis is done to enhance the natural frequencies of the single plate friction clutch to abstain from being in reverberation with the motor or engine frequency range. The outcomes demonstrate that normal frequencies of unique model and regular frequencies of improved model are in great concurrence with each other. ations, Volume 4, Issue 6, June 2014.

Paper No:AED#264

Planar Vehicle Dynamics Using Bicycle Model

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Abstract. There is a limit to which a vehicle will remain directionally stable during a steering maneuver. Vehicle configuration factors like position of center of gravity and Vehicle state factors like velocity and steer angles have a huge influence on the stability of a vehicle in motion. A lot of investments are made during a vehicle design process to make it stable and safe for occupants which include study of dynamics of the vehicle configuration. This study of dynamics can be achieved by studying the equations of motion for that vehicle configuration and by performing actual road tests which could be expensive sometimes. Thus, bicycle model discussed further is a quick and inexpensive way to analyze a vehicle configuration for its stability. Along with stability, the model can provide useful information like velocity vectors, yaw rates for a given input wheel torques and steer angles. The model is developed by deriving equations of motion for a simple two-wheel vehicle setup. The paper discusses in detail the process of deriving equations for a bicycle model and the way in which various factors affect the vehicle turn responses.

Paper No:AED#313

A Fatigue Crack Growth Life Prediction Modelfor Discontinuous Reinforced Metal Matrix Composite

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Abstract. A closed form multistage fatigue crack growth (MSFCG) life prediction model has been developed for discontinuous reinforced MMCs (DRMMCs) involving the microstructural features under the total strain-controlled conditions. The model considers crack initiation, small crack, and long crack life. The crack initiation is evaluated on the bases of slip steps deepening into a fatigue crackunder cyclic strain.Next, the small crack growth life is investigated within the microstructural threshold. Finally, for long fatigue crack propagation,previously developed model by Tevatia and Srivastava is modified and incorporated in the current model. Under the total strain-controlled conditions, reinforcement in the matrix results in an increase in both (i) the cyclic plastic deformation level and (ii) size of cyclic plastic zone near the vicinity of crack tip. The effect of initiation and smallcrack growth life issignificant for low cycle fatigue applications.

Paper No:ATFE#319

Energy Saving Analysis Using Pilot Operated Counter Balance Valve

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Abstract. Counter balance valves are used in hydraulic systems to withhold the vertical loads by preventing the free flow of the hydraulic fluid for the safety purpose. But due to this safety feature of the valve, it creates back pressure on the actuator, when the actuation of the cylinder is required in upward direction, to lift the load. This increases the pressure losses across the actuator in the hydraulic system and in turns heat the oil unnecessarily. This, in turn, causes the system to be energy inefficient. But, in today's competitive world development of energy efficient systems (EES) is an important aspect. In this article, comparison of energy efficient hydraulic system is done using Pilot Operated Counter Balance Valve (POCBV) and Conventional Counter Balance Valve (CCBV) through MATLAB®/Simulink environment. It has been found that POCBV is more energy efficient than CCBV for a particular set of operating conditions. Effects of physical parameters like pilot ratio, spring rate on stability and efficiency used in designing of POCBV are also studied and compared using MATLAB®/Simulink environment. This model is beneficial for hydraulic machine manufacturers engaged in designing of lifting devices in selecting a suitable valve for particular load application and for the designers to design the main components of the valve.

Paper No:AED#325

Prediction of Ride Comfort of Two-Wheeler Riders Exposed to Whole Body Vibration

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Abstract. Two-wheelers, being an important modes of transportation, exposes the rider to a higher level of whole body vibration (WBV) compared to cars. However the assessment and design modification to reduce WBV in two-wheelers haven't been explored in conjunction to the ride comfort. The present study develops a simulation model which can predict the effects of WBV on comfort level of two-wheeler riders as per ISO 2631-1. A 9dof lumped mass parameter vibration model consisting of 4dof seated human biodynamic model coupled with 5dof two-wheeler model has been developed and represented mathematically in state space form. Further, the model has been simulated in LabVIEW and the ride comfort on a two-wheeler in different simulated driving conditions, comprising of road profiles, vehicle speed, and duration of exposure, were assessed. Road profiles, vehicle speeds and, the duration of exposure were found to have a statistically significant effect on ride comfort.

Paper No:AED#329

Design and Analysis of Reciprocating Screw for Injection Moulding Machine

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Abstract. In this paper, the design and analysis of the reciprocating screw of injection moulding machine has been presented. The flow of melted material is control by the reciprocating screw inside the barrel, where the raw material of the product is melted. The proper flow of melted material is required, to obtain better quality of the product. Thus, the reciprocating screw can be considered as a critical component of injection moulding machine and its size varies model to model. The work presented is based on parametric modelling of reciprocating screw. The parametric modelling is carried out by merging Creo Parametric and excel spreadsheet using excel analysis as well as by using pro/programming of Creo Parametric modelling package. Using developed parametric model of reciprocating screw, three parameters (radius of screw, feed flight depth and metering flight depth) are required to generate the three-dimensional (3D) model for further analysis. The ease of present approach is very useful for the development of the different types of reciprocating screw in terms of variation in the said dimensions. The 3D model generated using parametric modelling has been analysed for the different materials (EN-41B, EN24, EN9 and EN8). The static structural and steady state thermal analysis has been considered to analyse stresses, total deformation, total heat flux and directional heat flux. The obtained result depicts that EN-41B has higher yield strength and EN24 has low total heat flux value. Thus, EN-41B can be considered where higher strength is required and for higher wear resistance EN24 is preferred for reciprocating screw.

Paper No:AED#330

A Neural Network Classification of sEMG Signals for Estimation of Force while Gripping

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Abstract. In recent years surface electromyography (sEMG) has been an important aspect for controlling of prosthetic and orthotic devices. However, such devices are still subject to discussion because of inability to perform actions of daily living. One such issue is the retrieval of clear neural information from noise-free EMG signals. In this paper, the objective is to identify optimal time domain sEMG features for a task of low level gripping force by performing classification with neural networking technique. The classifier was designed using an artificial neural network for different gripping force level. The gripping gestures were performed at two levels: first, simple gripping, when no force was applied and second, simple gripping with a force of 10N. The multichannel sEMG signals were recorded from 6 forearm muscles namely ECD, ECR, ECU, FCU, FCD and FCR. This paper helps to identify merits of ANN and importance of different forearm muscles for feature selection. The results obtained from the neural networking indicated root-mean-square (RMS) and waveform length (WL) as superior time-domain features. Further, extensor muscles were more responsive as compared to flexor muscles.

Paper No:AED#339

Design Issues In Multi-Finger Robotic Hands: An Overview

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Abstract. Multi-finger Robotic hands (MFRH) are desired similar to human hands in order to perform stable grasping and fine manipulation of different objects. Their industrial applications including material handlingfulfills the requirement of unique end-effector tool empowering specific reach, payloads, and flexibility. The design and control of dexterous and prosthetic robotic hands is of important concern these days. The performance of these hands depends on their mechanical design, prosthetics etc. The mechanical range of movement must be properly controlled and monitored to get the best performance of the robotic hand. In order to obtain the desired outcome from these robotic hands, various design parameters are discussed. The control issues of the multi-finger hand-arm system in order to interact with the human environment are also discussed. The objective of this paper is to evaluate multi-finger robotic hands capable of grasping a large variety of products. An overview of the relations between the designing features for the robotic hand, its anthropomorphism and dexterity is reported. Also, the best known robotic hands developed so far are reviewed emphasizing on their ergonomics and mechanical features. Based on these parameters, a newly designed four fingered tendon actuated robotic hand is discussed along with its mechanical structure.

Paper No:AED#344

Improvement in Tribological Behaviour of Brake Pad Material with Cnt-Ni-P Composite Coating and Compare with Al2o3-Ni-P Composite Coating

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Abstract. In mechanical machine components, the wear and friction are the major issues which are responsible for the fault and their failure. In this analysis, the tribological and mechanical properties of semi-metallic brake pad material was investigated. For improvement in the mechanical and triblogical properties of brake pad materials, Ni-P based multi walled carbon nano-tubes (MWCNT) and Ni-P based nano Al2O3 composite coating was used. The electroless coating technique was used for the coating as it results in excellent tribological properties such as good wear and corrosion resistance, uniform coating thickness, good hardness, etc. Energy dispersive x-ray spectroscopy (EDX) test was used to find the composition of the brake pad sample. Tribological parameters like frictional force and wear rate were determined by pin-on-disc tribometer.The result shows that the tribological properties of brake pad were enhanced after the coating and wear rate and frictional forces were less as compared to without coated sample. Field emission scanning electron microscopy (FESEM) was used to validate the result of the test.

Paper No:AED#364

Design and Analysis of a Novel Clover Leaf Combustor for Scramjet Engine

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Abstract. In recent years, there has been an increased interest in the field of scramjet engine and its combustor design studies. Researchers started adopting several new technologies in fulfilling the design requirements of the combustor like mixing characteristics, shock-elimination, low total pressure losses, high fuel penetration and cooling. Among them the shock eliminating capability and the total pressure losses are some of the key challenges. In this study, a novel idea of clover leaf shaped combustor is proposed to eliminate both the shock and total pressure losses encountered in a scramjet combustor. A baseline circular combustor and the modified clover leaf combustor have been numerically investigated at Mach 3 using density based K-ω SST (Shear Stress Transport) equations in CFD. The results show that the clover leaf structure has the tendency to eliminate the shock formation in the combustor thereby helps reducing the total pressure losses incurred in the combustor. Moreover, the reason to use clover leaf structured combustor is twofold, one it reduces the shock formation and the other one it provides a 16.58% increase in the flow velocity at which the continuous stabilized combustion can be achieved. Additionally, attempts were made to identify the optimized number of clover leaf structure by testing three clover leaf structures to eight clover leaf structures as briefly discussed.

Paper No:ARD#374

Evaluation of Tensile Properties of Hot Rolled Carbon Steel using Finite Element Analysis

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Abstract. The steel undergoes rolling above the recrystallization temperature is termed as hot rolled steel. In this process, steel billet transformed into a thin sheet with some specific properties. These thin sheets are easy to form or work with for several applications. Finite element analysis (FEA) technique is a powerful numerical method for solving several engineering problems. This technique not only reduced the experimental testing cost of materials but also provide the reliable test results for the same. In this article, the commercial HR1 steel was analyzed for tensile properties using FEA technique. The specimen dimensions were adopted from ASTM E8M standard. The 3D design of the specimen was created in CATIA and analyzed in ANSYS. When the applied load is 14 kN, the maximum stress obtained from the virtual analysis is matching well with the numerically obtained values. The maximum stress and strain in the gauge length were 279 MPa and 0.0014, respectively. Also, the calculated value of the maximum elongation was 7% for a 14kN load.

Paper No:AED#382

Continum Damage Mechanics Based Simulation of Ductile Fracture of Cylindrical Tubes

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Abstract. The importance of impact problems has led to extensive research work over the years. In an impact phenomenon the material is subjected to very short duration high force levels resulting in large plastic deformations and significant temperature rise. One of the most common phenomenon of the impact problem is occurrence of fracture. Fracture occurs when velocity of impact is very high. In metal it will lead to ductile fracture. Ductile fracture generally takes place due to void nucleation, then growth of the nucleated voids and at last voids coalescence to form a micro-crack. A number of studies on ductile fracture and damage simulation in static condition, have been carried out using this approach. But, there are limited study on the prediction of fracture in impact problems. In impact problems, the effects of strain rate, stress triaxiality and temperature on material behaviour becomes significant. In the present work, damage growth, and effect of high strain rate are studied for ductile fracture during high velocity impact of cylindrical tubes using commercial finite element (FE) software ABAQUS/Explicit using continuum damage mechanics (CDM). It is shown that CDM based modelling is able to capture the failure of the tubes as per experimentally reported results.

Paper No:AED#383

Experimental Investigation of Mechanical Strength and Temperature of Friction Stir Welded Joint

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Abstract. Friction stir welding (FSW) is one of the primary technologies in the manufacturing industry for joining. In the present article, an experimental investigation has been carried out to reveal the temperature range for the maximum mechanical strength of friction stir welded (FSWed) joint. Total thirty experiments have been designed by response surface methodology (RSM) for four input process parameters and five levels of each parameter. These experiments have been carried out and welding temperature data recorded through thermocouples. The mechanical testing results indicated that tool rotational speed as a most dominating parameter which influences the joint strength. Other parameters like traverse speed, tool tilt angle and dwell time also have a significant impact on ultimate tensile strength. Both response i.e. ultimate tensile strength and frictional temperature also have a correlation which can predict the joint quality. An optimization of the process parameters has been done for ultimate tensile strength keeping frictional temperature in the range. The optimized parameter settings have been validated by confirmation experiments.

Paper No:AED#387

Designing a Biomimetic Flapping Wing Air Vehicle Capable of Controlled and Sustained Flight

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Abstract. Flying vehicle that are propelled by flapping wings also known as flapping wing air vehicles (FWAV) / Ornithopters, have been a subject of exploration due of its possible use towards unmanned air vehicles (UAV) micro air vehicles (MAVs). Birds and insects fly with unprecedented agility in flight. These FWAV seek to mimic the motions of such naturally found species. They can find their use in military surveillance or for forestry and wild-life survey. Ornithopters are vehicles that generate the necessary thrust and lift by flapping motion. This exploration work contains a detailed description of the mechanical and the electrical systems used in the FWAV. This paper also focuses on the production process involved in the making of FWAV. This paper also given insight about the initial control experiments that were performed. Instead of focusing on problems of small MAV which revolves around actuator miniaturization and energy storage. Our work concerns itself more with the topic of robot locomotion. Thus, it will give details about how one can achieve better stability and control on the flight of an Ornithopter. The developed FWAV has a wingspan of 1.17 m, designed for a kerb weight of 1000 grams. The prototype has been designed specifically for the use of exploration. Designing make extra efforts to enhance payload size, control stabilization, wing efficiency and crash survivability.

Paper No:AED#393

Modelling and Analysis of Magneto-Rheological Damper for Maximizing the Damping Force

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Abstract: In this article, modelling of the Magnetorheological damper (MR) damper and its finite element analysis (FEA) is presented. The axisymmetric FEM (finite element method) model of the MR damper was built using ANSYS Maxwell software. The MR damper was modelled using the geometrical parameters which were selected using the literature survey and then magnetic flux density was calculated & studied at the clearance space of the MR damper. The developed FEM model was used for determining the damping force of an MR damper with selected geometrical parameters. This article demonstrates that the developed FEM model for the MR damper can be used for predicting its damping force. The data gathered from this article will help the future researchers to know in depth the FEM modelling of MR damper and also provides a procedure to estimate the damping force.

Paper No:AED#398

Multiscale Analysis of Bulk Metallic Glasses for Cardiovascular Applications

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Abstract. Bulk Metallic Glasses, an important class of amorphous metals with no long-range structural disorder, appear to have a futuristic potential for a wide range of applications. Some of the significant properties which bulk metallic glasses possess include optimistic Young's modulus, good fatigue endurance, higher strength, non-toxicity, improved wear resistance and excellent corrosion resistance. Most vital property of Bulk Metallic Glasses is that it eliminates the surface defects like cracks and crystalline defects like dislocations. These reasons have led to extensive research interest on bulk metallic glasses for biomedical applications such as implant materials. Research till date has a minimal contribution towards the development of Bulk Metallic Glasses as characteristic materials for biomedical applications. In this work, Cu-based bulk metallic glass with a compositional variation of Zr, Al and Ag alloying system ismodelled using Multiscale methods for cardiovascular stents. Analysis of the simulation results obtained using LAMMPS software, for various compositions of Bulk Metallic Glasses indicates an incremental change in Young's modulus, ultimate tensile strength, and fracture mechanism is by void formation. The variable strain rates have a considerable effect on the mechanical properties as well as failure mechanics. It is evident that the soft spots due to local structural variations tend to act as initiating points for fracture. The mechanical properties of Bulk Metallic Glasses obtained by Multiscale Modelling are in conformance with the requirements of cardiovascular stents, sufficing that the present compositions of Cu-Zr/Ag/Al can be considered as apt materials.

Paper No:AED#408

Effect of Front Slant Angle on Aerodynamics of a Car

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Abstract. In this study, flow over the surface of a simplified Car Body is investigated using Computational Fluid Dynamics. 3D Modeling is carried out in Creo and simulation is carried out in ANSYS Fluent. Car is assumed to be moving at 40m/sec (~150 kmph).Flow behavior such as velocity profile, static Pressure, coefficient of drag and lift is determined. Three different cases of slant angles of the front windshield are taken i.e. 20˚, 25˚ and 30˚ and their effect on aerodynamics of the car is determined. Comparison is then performed for static pressure, velocity profile, drag and lift coefficient. Simulation results showed that the slant angle of 25˚ is most suitable of all, as the coefficient of drag and lift is minimum in this case.

Paper No:AED#417

An Isogeometric Based Study of Mortar Contact Algorithm for Frictionless Sliding

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Abstract. Apart from the material, geometrical, and boundary non-linearities, the enforcement of the contact constraint in an accurate manner is considered to be a major issue for the numerical simulation of the contact problems. So far, due to the default features of NURBS-based isogeometric analysis (IGA) technique, e.g., its ability to represent the exact form of a geometry even at a coarse discretization, it has been widely utilized for the study of contact problems. For the application of IGA technique to the contact problem, the mortar contact algorithm has been preferably employed in comparison to other contact algorithms. As of now, significant efforts have been made and are still continuing to effectively simulate the different class of contact problems varying from small to large deformation through the application of the IGA based approach. In this contribution, the mortar based isogeometric contact algorithm is utilized for the numerical simulation of a large deformation frictionless contact problem. For the purpose of validation and to ensure the convergence of presented simulation, second and fourth order of the NURBS basis functions are used for modelling of the considered problem.

Paper No:AED#444

Serviceability Analysis of a Footbridge Subjected to Pedestrian Walking

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Abstract. The paper presents a methodology to study the vibration response of beam-type footbridges subjected to the pedestrians group. A simply supported concrete beam is modeled in Ansys and modal analysis is performed. Some of the natural frequencies fall in the range of human activity. The pedestrian load is considered only in the vertical direction and represented as a Fourier series with five dominant harmonics. Identical individual pedestrians walk on the bridge centerline with the same walking frequency such that at any time there is a group of one, three, five and ten pedestrians on the bridge. Moreover, another case considers, three parallel group of pedestrians walking in a row. The acceleration response of the bridge shows that the bridge vibration is unstable at the resonance condition for the first mode. The bridge fails the pedestrian comfort limit defined in codes. It requires some vibration mitigation measures or structural modification to reduce the vibration.

Paper No:AED#452

Experimental Study on the Steady-state Performance of Closed-circuit Hydrostatic Transmission Drives for the Rotary Head of Blast hole Drill Machine Using Different Capacities Bent Axis Hydro-Motor

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Abstract. Blast hole drill machines are used for drilling in rocks which are of soft and medium-hard nature. In such machines, the drilling is accomplished via a hydrostatic transmission (HST) drive. This article presents the steady-state behaviors of two different HST drive for the rotary head of drill machine. In the first drive two high-speed low-torque (HSLT) hydro-motors, having an individual capacity of 10 cc/rev with the gear reducer having 15:1 gear ratio; whereas in the second drive identical numbers of hydro-motors, having an individual capacity of 16 cc/rev with the gear reducer having 10:1 gear ratio is employed. Bond graph technique has been used for modelling the drives. Based on the model, the analytical relations associating the torque loss, slip and the overall efficiency linked with the drives are derived. By utilizing them, the performance corresponding to the HST drives is obtained in terms of the normal operating speed range linked with the drill machine utilized in mining applications. From the study it is observed that, for the constant load torque and the drill speed, the second drive (combination of two identical higher size hydro-motors along with a lower size gear reducer unit) shows better performance than the first drive (combination of two identical lower size hydro-motors along with a higher size gear reducer unit).

Paper No:AED#458

Low Rolling Resistance Tires for E-Rickshaws for Increasing Range and Capacity

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Abstract. In the next 30-40 years there will be an immediate need for an alternative method of transportation. Pollution is another major issue. Hence electrically charged transport system is logically the best alternative for the future. I have focused on the Electric-Rickshaws running in my city and is the best and cheapest mode of transportation for city hops. In one charge these E-Rickshaws can run up to 80 Kilometers. But what if the range of the E-Rickshaw could be increased by reducing the energy losses and increase its range. One way this can be achieved is by reducing frictional resistance of tires used in E-Rickshaws. It is found that 15% of the fuel is used in overcoming rolling resistance of the tires. This paper has presented different methods for reducing the Rolling Resistance on the tires of E-Rickshaws. Silica is the most preferable material that can replace the traditionally used carbon black fillers. Various other methods are presented in this paper. Finally the results are analyzed using Ansys software taking load factor and inflation pressure into consideration.

Paper No:AED#471

Structural Analysis of Pechora Missile System's Launcher Beam

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Abstract. Pechora Missile system is an old and vintage system used for launching surface to air missiles. The Launcher beams of the Pechora missile system undergo fatigue over time due to structural load, wear and tear, aging .This results in crack propagation which ultimately leads to the failure of the Launcher beam structure. In this research work structural integrity of the Launcher beam is investigated by performing analysis of launcher beam using Finite Element Method (FEM). The paper concludes by suggesting methods to optimize the design of the launcher beam to overcome structural failure.

Paper No:AED#474

Development of AHP Framework of Sustainable Product Design and Manufacturing for Electric Vehicle

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Abstract. In the present scenario, the success of an industry depends on its sustainable manufacturing performance where competitiveness is followed by superior performance. To remain competitive in the market, the manufacturing companies need to evaluate their performance through the manufacturing sustainability. This paper presents an AHP-based model for enablers of sustainable manufacturing evaluation in Indian manufacturing Companies. A hierarchy structure is established based on the proposed key enablers of sustainable. The company's score is calculated to assess sustainability in manufacturing against the enablers and the companies rank is determined based on their scores.

Paper No:AED#475

Design of Microfluidic Paper based Device for the Detection of Nitrogen Dioxide in Atmosphere

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Abstract. Pollutant gases from industries and certain processes like welding, exhaust of internal combustion engines, use of explosives, use of nitric acid etc. are the sources of sulphur dioxide (SO2), nitrogen oxides (NO2 and N2O5) which become the part of atmosphere. The heterogeneous reactions of atmospheric aerosol convert these gases to sulphuric, nitrous and nitric acids which precipitate as acid rain and thus severely affect human health. In this paper, the design of colorimetric paper based microfluidic device is presented to detect and quantify nitrogen dioxide (NO2). In order to reduce the cost of device and ease of fabrication, wax printing for fabricating paper based Analytical Device (μPAD) is proposed.

Paper No:AED#488

Experimental, Computational and Chemical Kinetic Analysis to Compare the Flame Structure of Methane-Air with Biogas-H2-Air

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Abstract. This paper presents a numerical and experimental investigation of the laminar burning velocity and flame structure of methane, biogas, and hydrogen-enriched biogas. Experiments were performed on flat flame burners based on heat flux method, and numerical computations for the flame structure were conducted over the same burner using three-dimensional CFD simulations with DRM19 detailed chemistry. To get an insight of important chemical reactions, sensitivity analysis of the studied mixtures was also conducted using ANSYS Chemkin-Pro® with GRI-Mech. 3.0 reaction mechanism. All experiments and numerical simulations were conducted at 1 atm and 298 K. The experimental results show that the laminar burning velocity of the methane-air mixture reduced by 47% when diluted with 50% carbon dioxide. On the other hand, 40% hydrogen addition in the biogas-air mixture (containing 30% Methane + 30% carbon dioxide), enhanced the laminar burning velocity by 117% compared to pure biogas-air mixture at stoichiometry. The three-dimensional CFD computational results predicted a 580 K drop in temperature, 32% reduction in CH3 concentration and 30% reduction in CO concentration for methane, when diluted with 50% carbon dioxide. Chemical kinetic analysis of methane-air, biogas-air and 40% hydrogen-enriched biogas-air mixture predicted H+O2↔O+OH (R38) and H+CH3(+M)↔CH4(+M) (R52) to be most dominant reactions with positive and negative sensitivity coefficients respectively. However, the dominance of these reactions were significantly higher in hydrogen-enriched biogas-air mixture compared to pure methane-air mixture due to the increased production of H and OH radicals in the reaction zone.

Paper No:AED#491

Optimization Design for Aerodynamic Elements of Indian Locomotive of Passenger Train

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Abstract. The objective of this paper is to optimize the WAP-5 Indian locomotive with the help of a multi-objective optimization technique so as to steady the plural aero dynamic factors. An evolutionary algorithm along with shape parameterization method which makes use of B-spline curves and Coons patches and also a computational simulation which makes use of a message passing interface are involved in this multi-objective design optimization method. For determining the efficiency of this technique, we design a train head which has optimized aero dynamic drag and aerodynamic forces in relation to affecting other trains. Reasonable Pareto results were obtained with the help of a 10th generation evolutionary algorithm.

Paper No:AED#516

Estimation of Load Carrying Capacity for Pin-Mounted Hydraulic Cylinders

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Abstract. The standard hydraulic cylinder consists of two main parts i.e. cylinder tube and piston rod. It operates by the reciprocation of either element and majorly used to transmit mechanical power using fluid linkage. The failure of such systems occurs usually because of piston rod failure. Being more specific, the buckling failure mode is more dominant over others. In this manuscript, the maximum allowable load is calculated for a standard hydraulic cylinder with pin-mounted at both ends analytically using analytically using ISO TS 13725. Piston rod having less flexural rigidity (EI) is prone to buckling failure. The estimated load when applied on the piston rod end results into the stress condition of the cylinder tube. Von-Mises stress generated in the thick cylinder is discussed using Lame's theorem while axial and flexural stress for piston rod is deliberated. The results show that for lower slenderness ratio hydraulic cylinder may fail due to yielding of cylinder tube failure. The results obtained for slenderness ratio 19 of piston rod are compared with simulated results implemented in ANSYS.

Paper No:AED#540

Augmented Reality based Simulation of Spring Mass System

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Abstract. In recent decades' various user interaction technology makes the presence to visualize complex behavior of dynamical system. In these technology Augmented Reality (AR) immersed as a viable choice for the interaction between reality and simulation. Augmented reality base simulation is computer based superimposition of image on another image. In the present work, MATLAB and unity3D based simulation has been done for a spring mass system has been presented. Computer based image processing has been performed by MATLAB. A tracking algorithm and Simulation code is developed by using MATLAB to get enhance the interaction between real and virtual system. The result of study will be quite useful for the rapid prototyping and vibration engineers

Paper No:AED#547

Kinematic Analysis of Bionic Vibratory Tillage Subsoiler

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Abstract. The paper presents the kinematic analysis of bionic vibratory subsoiler used for agricultural tillage operation. Bionics is the study of the mechanical systems that function like living organisms or parts of the living organisms. Studies have reported that application of bionics in design procedure improves the working system efficiency. A crank-rocker mechanism is selected from the available literature for vibratory tillage operation in banana cultivation. The required trajectory of the crank-rocker mechanism for bionic vibratory subsoiler is examined through kinematic analysis. Velocity and acceleration required for the tillage tool operation are identified through kinematic analysis.

Paper No:AED#552

A Comparison of Recent Experimental Techniques to Measure Acoustic Properties of A Muffler

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Abstract. The Transmission Loss (TL) is an important acoustic property to evaluate the performance of a muffler, which needs to be thoroughly discussed and analysed. In this work, the two most commonly used techniques for obtaining TL i.e. Two Load method and Two source method are discussed and compared experimentally. The experiments have been done using various in-house fabricated mufflers with different geometrical dimensions. The muffler being used for experiments is Extended Tube Resonator. An impedance tube has been used for determination of TL experimentally. Experimental results obtained for TL using the two methods are compared qualitatively and it has been observed that in some cases, Two Load Method gives clear frequency information as compared to the Two Source in high frequency ranges. However, good agreements between the two methods were obtained in most cases.

Paper No:AED#553

Investigating Inlet Pipe Configuration of Muffler to Study the Performance using CAE Modeling and Simulation

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Abstract. Mufflers are one of the integral components of the exhaust system of an automobile. Their main application is to attenuate the noise level caused by the exhaust gases coming from the combustion chamber. Designing and manufacturing of a muffler of our desire used to be a very long process of hit and trial method which would then be dragged by a number of tests. Due to environmental regulations, companies use reliable methods for modeling and testing of mufflers. Recent advancements in emission studies have made designing and testing a muffler numerically a convenient approach. This paper will deal with the experiments to study the performance of the muffler at early stages of design. This study will deal with the outcome of different inlet pipe diameters and how that affects different parameters like transmission loss, acoustic pressure and sound pressure.

Paper No:AED#563

Temperature and Traverse Force Analysis during Underwater Friction Stir Welding

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Abstract. Friction stir welding (FSW) is an auspicious clean welding method to join marine grade aluminum alloys (AAs).Underwater Friction Stir Welding (UFSW), can extend the marine application of the FSW due to its superior mechanical properties over its contemporary FSW. In FSW/UFSW the weld thermal cycles and tool forces exhibit a noteworthy effect on the weld properties. Force and temperature measurement during UFSW process play a pivotal role in understanding the process, prediction of tool life, microstructure and mechanical properties of the welded joints. As such an attempt has been made in this study to investigate the effect of welding speed (50 mm/min-80 mm/min) on temperature distribution and traverse force during UFSW of AA 6082-T6. The results revealed that increase in welding speed caused high traverse force and low peak temperature. Furthermore, the increase in temperature was observed as the tool approaches the thermocouple near the weld center. After that, the temperature reduces due to a decrease in the thermal gradient. The maximum peak temperature of 137 0C was observed at the retreating side (RS) in heat affected zone (HAZ) at a low welding speed of 50 mm/min due to high heat input and slow cooling rate. Additionally, the maximum traverse force of 103 kgf was attained at a high welding speed of 80 mm/min due to high material flow stresses resulting from high strain rate and low temperature.

Paper No:AED#567

A Comparative Study of Five Explicit Time Integration Algorithms for Non-Linear Dynamic Systems

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Abstract. For the numerical simulation of the dynamic structural problems, special attention is needed to be paid while choosing the time integration algorithm. The task becomes even more challenging if any non-linearity (especially the boundary non-linearities) is involved in the system. In the literature, a number of time integration algorithms are available. However, the choice of an appropriate time integration algorithm is an essential criterion to ensure the efficiency and the robustness of the numerical simulations. The difficulty in this choice resides in being able to combine the robustness, accuracy, and the stability of the algorithm. Time integration algorithms are usually classified into the two categories: 1) explicit, and 2) implicit. For stability reasons, explicit algorithms use smaller time-step in comparison to implicit algorithms. Explicit algorithms are used for the multi-degree-of-freedom system having various non-linearities, e.g., geometrical, material, and boundary, for which carrying out the iterations operation becomes prohibitively expensive, and convergence issues are frequent. In this contribution, the stability, robustness, and the accuracy of popularly employed explicit time integration algorithms are investigated and compared through a number of single and multi-degree-of-freedom nonlinear systems.

Paper No:AED#599

Design & Analysis of Steering Knuckle Joint

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Abstract. The steering knuckle joint acts as a connection between wheels and suspension system with the help of which the wheels of the vehicle are turned. Here spindle type steering knuckle of an ATV was taken as a specimen. It was analyzed and re-designed according to specific external conditions with the help of CAE. The point cloud data of the component in .STL file format was prepared with 3D Scanning, and then this cloud data was used to get the CAD file with NX software. The CAD data file is common input file which can be read easily by any design and analysis software, so conversion was necessary for further processing the collected data. The collected data was analyzed with ANSYS software for stress optimization. The analysis was done while considering two main factors which were weight & failure. Then CAD model was tested for different loading conditions. After analysis, the steering joint was redesigned according to the results obtained. The results show that re-designed knuckle has more curved edges which reduces the stress concentration, and also it was optimized further to improve its performance.

Paper No:AED#606

Frontal Car Crash Analysis using Finite Element Method

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Abstract. This paper deals with the finite element simulations for the crash characteristics and the energy absorption of thin longitudinal members of square and rectangle cross-sections using steel and aluminum as well as a basic comparison is done between the two profiles and materials. The finite element model is simulated using AUTODYN solver in explicit dynamics. Specific energy absorption and Peak forces experienced are the main variables that are used in the study. The square shape provides a 16% increase in specific energy absorption and 15% rise in the peak force experienced when compared to the rectangular shape while the use of aluminum reduces the weight by 63% consequently there is a decrease in both specific energy absorption by 24% and peak force experienced by the longitudinal member by 64%.

Paper No. AED#609

Performance Enhancement of an All-Terrain Vehicle by Optimizing Steering, Powertrain and Brakes

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Abstract. All-Terrain Vehicle is an off-road vehicle which can withstand harsh terrains. The steering system, transmission system and brakes are one of the integral parts of the buggy which is responsible for providing directional stability and power transmission, respectively. This paper focuses on the weight optimization and performance enhancement of the buggy by making alterations in the steering and transmission system of the vehicle. In the steering system, alternate material was used and in the transmission system, forward and reverse gear box was replaced with continuously variable transmission and chain sprocket arrangement. A mathematical model was developed and compared with the result obtained from ADAMS/CAR. The decisions were made keeping in mind the safety, drivability, reliability, maneuverability, manufacturability and performance aspects of the vehicle.

Paper No:AED#639

Effects of Post Weld Heat Treatment on Microstructure and Mechanical Behavior of Friction Stir Weld Thick Section AL-ZN-MG Alloys

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Abstract. Friction stir welding is considered to be a promising solution to successfully join high strength 7000 series aluminum alloys. However, questions related to decrease in weld mechanical properties with increase in plate thickness still remain unanswered. In this study, 16 mm thick AA7075-T651 aluminum alloy plates were successfully joined by friction stir welding. The welds were heat treated using a special solutionizing method called cyclic solution treatment (CST). The effects of CST on mechanical behavior and microstructures of the welds were studied using hardness, tensile, and impact tests and optical microscopy. The post weld heat treatment significantly improves the hardness of the joint and homogenizes the hardness distribution across the welded joint. However, the tensile properties and impact toughness of the welds were not found to be beneficially affected. A significant grain growth in the weld nugget was observed after CST.

Paper No:AED#662

Graphene: An Effective Lubricant for Tribological Applications

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Abstract. The objective of this review paper is to investigate the basic tribological behavior of graphene, the first existing 2-D material and to enhance its performance as a self-lubricating material. The significant and prospective impact of this new class of material was first acknowledged in 2004 by Geim and Konstantin Novoselov who were awarded Noble prize for their discovery and development of graphene in 2010. In previous decades, reducing friction coefficient and wear-related failures in mechanical systems has gained serious attention due to friction's adverse impacts on effective life and durability of the mechanical systems. To reduce the friction and wear mechanism in the moving mechanical systems, the research proceeds in the development of novel materials, coatings, and lubricants (both liquid and solid) which have the potential of reducing friction and wear in materials. Despite intense Research & Development efforts on graphene for a numerous existing as well as future applications, its tribological potential as a lubricant is still relatively uncharted. In this review, we provide relevant research of recent tribological studies on graphene especially, its use as a self-lubricating solid or as an additive for lubricating oils. A comprehensive review is provided with the aim to analyze such properties of graphene.

Paper No:AED#672

Dimensional Errors during Scanning of Product using 3 D Scanner

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Abstract. Non-contact scanners are available commercially as there is need to understand their application in the current processes and products. This work tries to, explore the dimensional errors in the scanning process and also the best process parameters for using a 3D scanner. COLIN software was used with the scanner to convert the data of physical product into cloud data (3D CAD) file. Used UNIGRAPHICS software used to check the actual dimension of the digital file. Two tensile test specimens were taken to verify the scanning accuracy of the products by using the scanner. Results identified that there was scanning error in tensile test specimen 1 & specimen 2 during the first time. The scanning error occurred due to seven main reasons, i.e. selection of wrong reference point, out of field of view, alignment in measurement not appropriately done, calibration of the scanner, temperature out of range, software problem and post-processing. The scan depth and projected angle also affect the dimensional accuracy. After studying these parameters and finding the causes of error, we tried to improve these factors to improve scanning accuracy. Then again scanning of the same tensile test specimen 1 and specimen 2 was done and data obtained, as compared with first scan data. From this comparison, we identified lesser dimensional errors comparatively during the second scan which was taken after improving the factors. So factors identified to improve the dimensional errors.

Paper No:AED#687

Friction and Wear Characteristics of Heat Treated Medium Carbon Alloy Steel

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Abstract. The microstructure of a material can produce excellent mechanical properties as well as they have strong influence on mechanical properties like strength, toughness, rigidity, ductility, hardness, corrosion resistance, wear resistance and so on. The microstructure of alloy steel again depends on the types of alloying constituent present in the particular steel, their concentrations and the heat treatment procedure of the alloy steel. Heat treatment is basically the heating process of the material at desired temperature, allowing the material to dwell at that temperature for a specified time and finally cooling at room temperature. Various categories of microstructures may be developed depending on the cooling process. In the present research work, medium carbon alloy steel has been heat treated to give annealed, normalized and quenched samples. Heating has been done in an electric muffle furnace followed by cooling inside the furnace, in open air and in cutting grade oil (grade 44) to give annealed, normalized and quenched samples respectively. Hardness of all the samples have been measured in Rockwell C scale and compared accordingly. Microstructures of all the samples have also been observed using an optical trinocular microscope and discussed. Finally tribo characteristics, that is, the study of friction and wear of the heat treated samples have been conducted in dry condition and under fixed parametric combinations of normal load on job, speed of the wheel (rpm) and cycle time. 'Winducom 2006' software supported multi tribo tester "TR-25" (Ducom) has been used for this experimental study. All the test results have been tabulated, compared and concluded accordingly.

Paper No:AED#679

Optimization of Process Parameters for Erosion Wear in Slurry Pipeline

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Abstract. In this paper, erosion wear behavior of slurry flow has been investigated using a slurry erosion pot tester. Bottom ash is taken as the erodent material with varying concentration. To assess test data, Taguchi's design of experimentation, is used. The influence of test parameters on erosion wear could be estimated by computing signal-to-noise ratio and analysis of variance. L9(32) orthogonal array is used for the investigation. From analysis of test results, it is determined that speed has found as the most influencing parameter on erosion wear of base material. Based on experimental data it is clearly revealed that erosion wear have strong dependence on rotational speed (N) as well as solid concentration (CW) and testing time (T) also.

Paper No:AED#693

Assembly of Mechanical Parts In Virtual Environment

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Abstract.A virtual reality head set device is developed to get the virtual environment of a real world with the help of VR convertor software. The virtual head set is used to assemble the 3D design of automobile engine part in virtual environment using Autodesk 360 fusion software, VR headset, VR con- vertor (Trinus VR software), Arduino IDE software, ATMEGA 320P, hand ges- ture reader device, gyro sensors, magnetometer sensor and 5.7 inch screen dis- play. The programming language used in the present study is Arduino IDE software is C++. The computer read the gesture of gyro sensor with the help of selected codes. The assembly simulation of the costly products can be carried out before actual practice and the financial loss pertaining to accidents and monitory damages can be minimized

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Paper No:AED#719

A Comprehensive Review of materials used for 4D printing

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Abstract. Rapidly 4D printing has made tremendous growth in diverse fields such as healthcare, aerospace, manufacturing industry and advanced manufacturing systems. This technology is found to have a greater potential while considering the daily applications and the economy. Besides this 4D printing allows the conversion of a 3D printed structure to perform some interaction mechanisms by changing the functions based on the response time to parameters such as temperature, pressure, water and light and so on. Also 4D printing is function of time, printer independent targets shape and functionality. Therefore, this paper conducted an exhaustive review of the recent researches in materials and designs leading to its use in a 4D printing process. This review also incorporates a detailed survey of smart material and multi-materials used to change the function and shape of those materials after printing. An attempt has been made in this paper to cover a more conclusive review in deciding the best appropriate material that may well be utilized in 4D printing process.

Paper No:AED#724

AutomotiveHeavy duty Wrench for Defence Purpose.

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Abstract. The difficulties in heavy commercial and Indian defense forces heavy duty truck treys include Tyre damage, greasing which needs to disengage the Tyre from the hub. In such cases, operator needs to change the Tyre at the spot of incident manually with some extra man made efforts. Using single rod with sockets require lot of human effort and is risky and may cause injury to the operator while applying force on it ,also it is very much time consuming as each Tyre has 10 nuts. The present work, automotive heavy duty wrench is designed to loosen and tighten all the 10 nuts of vehicle tyre where high torque is required at the same time. Automotive heavy duty wrench works on the principle of multi stage epicyclic gears. It creates a mechanism which increase the torque, necessary to loosen the nut. It is designed in CAD software and static and dynamic characteristics will be analysed using Ansys –Workbench.

Paper No:AED#718

Design and Analysis of Solar Cabinet Dryer for Drying of Potatoes

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Abstract. A series of experiments were conducted on drying the potatoes via forced convection of heated air in an indirect type solar cabinet dryer. Variation of the chamber temperature, thickness of the potato slices and optimization of the water flow rate to radiator was done. No pre-treatment of potatoes was carried out before commencing the experiments. The data viz. the relative humidity inside the dryer, solar irradiation over the collector, temperature rise across the drying chamber and the weight lost by the specimen during the process of drying were collected. Analysis of data showed the increased drying rate with chamber temperature at a given air flow rate. For the slice thickness of 0.25cm, the rectangular slices retained faster drying rate compared to the square slices, while the circular slices showed the least drying rate. However, for the slice thickness of 0.5cm, the rectangular slices still retained faster drying rate, while square slices showed the least drying rate. The energy, exergy and cost analysis (simple payback period) of the setup were carried out.

Paper No:AED#726

Graphene/MoS2 Based Fix-Fix Type RF-NEMS Switches-A Simulation Study

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Abstract. In this work, modeling, simulation and analysis of a fix-fix type RF- nano-electromechanical switches (RF-NEMS) with very low actuation voltage and enhanced RF-Performance is presented. The switches are modeled using previously known theory from literature. The various performance parameters are computed like modal frequencies, casimir force, electrostatic force, capacitance, release time, actuation voltage and S-parameters are computed using ANSYS structural and HFSS software. The switch exhibits low actuation voltage < 1 V for different thickness of graphene/ MoS2 as a beam material. Resonant frequency of graphene based beam for first, second and third mode are found to be 72.5 kHz, 86 kHz and 416 kHz, respectively while for MoS2 based beam 27 kHz, 34 kHz and 94 kHz, respectively. It is concluded that low actuation voltage NEMS switches can be realised using single layer 2D material giving low insertion loss.

Paper No:AED#727

Vibration Response of Human Subject using FEM

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Abstract. Human body suffers when exposed to different vibration conditions that generated by travelling, working with machines etc. in sitting and standing posture both. In this study, modal analysis has been performed on 54 kg Indian human subject to find out the natural frequency and deformations for both sitting and standing posture under un-damped vibration conditions. An ellipsoidal approach has been used to model human subject as 3-D CAD model using physical dimensions and anthropometric data available in existing literature. Human subject is divided into different segments to convert complex human body into simple model using ellipsoidal shape of each segment. The results obtained in this study, will be helpful in designing components for human use like automobile seats, lifts, escalators, machine parts etc. Also, in this study a comparison has been done in the results obtained in sitting and standing posture analysis. Further, it was found that with the increase in natural frequency, deformation increases in both the cases.

Paper No:AED#746

Comparative Model Analysis of Brake Rotors

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Abstract. Brakes in any vehicle are of an utmost important device. Since, brakes by converting the kinetic energy of wheel to be precise that of the brake rotors to heat energy and bring the vehicle to a complete stop. Com-putation of the stresses and analysis of vibration characteristics of brake rotors considerably help to avoid failure and possess the ancillary benefits of having optimal weight and cost. The present paper deals with designing two different designs of brake rotors, conventional and a periphery brake rotor using Solid Works software and its structural analysis using ANSYS software. Modal analysis is done to enhance the natural frequency of the brake rotors, so as to compare that which design of the rotor in particular shows the lesser deformation and much more susceptible frequencies. Fi-nite element analysis (FEA) is generally used to show the dynamic response of a structure and has the advantage that complex geometries can be mod-elled to high accuracies. But accuracy of the FEA can be sketchy and the unwavering quality of the FE model must be approved by looking at the anticipated outcomes of natural frequencies and mode shapes of the FE model with the experimental results. The results show that natural fre-quencies of original model and natural frequencies of simplified model are in great concurrence with each other.

Paper No:AED#787

Research on Braking Performance Using Scaling Methodology on Disc Pad in Disc Brake System

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Abstract. Automobile is a big invention in itself, which comprises of engine, clutch, transmission, suspension brakes and other major components. Out of these components, brakes is the only vital components over which not much research have been done. Many advancements have been made in braking technologies over the time. Among which disc brake system is the safest and advanced braking mechanism. Performance of a disc brake system depends upon parameters like heat generated, speed of the vehicle, rotor and disc pad material and other environmental conditions. Later on, these parameters result into stopping distance, braking power, deceleration time, and thermal gradient depends upon disc pad and rotor contact region. If this contact region undergoes any change, parameters like temperature distribution, contact pressure distribution, total deformation and equivalent stress will ultimately get changed. This research paper emphasis on the using scaling methodology in disc pad to analyse and simulate the outcomes of changing measurements of disc pad in disc brake system. This paper aims to determine disc temperature and to examine stress concentration, structural deformation and contact pressure of brake disc and pads during single braking stop event. The thermal-structural analysis is then used with coupling to determine the deformation on both the assemblies. Temperature and equivalent stress analysis carried out in fluent. The designs have been made in Solidworks and analysed in ANSYS workbench

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Paper No:AED#790

Mechanical and Tribological Behaviour of Al-ZrO2 Composites: A Review

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Abstract. Aluminium metal matrix composites (AMCs) reinforced with hard ceramics are highly demanded composites which have the potential of fulfilling the current demands of advanced industrial applications due to its light weight and high strength properties. This paper attempts to review the various properties (microstructural, physical, mechanical and tribological) of the Al-ZrO2 reinforced composites. The microstructural results obtained by the many researchers showed the uniform distribution of the reinforcement particles within the matrix and good bonding between them. The physical and mechanical behaviour of the composites enhances with the increment in the weight content of the ZrO2 particles. It has been observed from the literature that the tribological properties also improved with the addition of the ZrO2 particles within the Al matrix.

Paper No:AED#807

Design and Finite Element Simulation of a Trailing Arm Suspension System

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Abstract. The suspension system of a vehicle is responsible for absorbing the vibrations during vehicle movement, thereby providing reliability and stability to the vehicle. The components of the suspension system enable damping the vibrations and avoid transmitting them to the frame. The major components of the suspension system along with their loading condition are discussed in this paper. An attempt is made to analyze the structural behavior of the trailing arm of the suspension using FEM simulation by meshing and strength analysis using ANSYS analysis software. ANSYS static structural analysis module is used to verify the stress developed in the automobile suspension system. The distribution of the load on the trailing arm and the critical section is presented in this paper.

ADVANCES IN INDUSTRIAL AND PRODUCTION ENGINEERING

Paper No: AIPE#4

Statistical Analysis of Surface Roughness Using RSM in Hard Turning of AISI 4340 Steel with Ceramic Tool

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Abstract. The present study concerns the modelling and optimization of surface roughness in dry hard turning of high strength low alloy (HSLA) grade AISI 4340 steel (49 HRC) with coated ceramic tool. For parametric study, the turning operations have been established according to Taguchi L27 orthogonal array consisting of an experimental design matrix 3 levels and 3 principal turning parameters (factors) such as, cutting speed, axial feed and depth of cut. Analysis of sixteen set experimental data with ANOVA showed that axial feed and speed are the most significant controlled cutting parameters for hard turning operation, if the improvement of the machined surface finish is considered. Thereafter, statistical regression model based on response surface methodology has been proposed for correlation of cutting parameters with machined workpiece surface roughness. Finally, optimal cutting conditions with the aim to minimize the surface roughness via desirability function approach of RSM is proposed.

Paper No: AIPE#7

A Review on Different Dielectric Fluids and Machining of Si3N4 and Al2O3 Composites via EDM

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Abstract. The limited efficiency and lack of feasibility of Traditional Manufacturing Processes (TMP) in ceramic industry restrict their applications in the machining of the ceramic materials having high hardness and brittleness. The use of unconventional methods of manufacturing overcomes the constraints of the conventional processes and therefore, find an enormous application in the industrial sector. Present study primly focuses on the Electrical Discharge Machining (EDM) of ceramic composites and reviewed the different dielectric fluids that are being used in the modern machining, along with their effects on different EDM parameters like Material Removal Rate (MRR), Tool Wear Rate (TWR), Surface Roughness (SR), and Surface Hardness (SH) as well as the ability of EDM for machining the ceramic composites. It focuses on the main input parameters of EDM which influence the metal cutting procedure and discusses the machining of the ceramic materials like Al2O3 and Si3N4 based using EDM. The current study reveals that EDM is one of the best methods in machining the ceramic composites because of its high efficiency, high precision and accuracy.

Paper No: AIPE#47

Supply Chain Issues and Challenges for Cement Industries of India: A case Study

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Abstract. Supply Chain Management (SCM) has become very important element for modern industry success. SCM integrate the all inbound & out bound activities of a company. Cement industries are the core manufacturing sector affecting the growth of modern India. The cement industries in India are facing different challenges in modern time of competition. After GST Implementation in India cement Industries faces many issues and challenges. Supply chain of cement industries has transformed a lot. In this paper authors have discussed the supply chain issues and challenges of cement industries in India and the impact of GST (Good & Service Tax) have also been discussed. Old supply chain, modified supply chain, & critical factor like warehousing eliminations, effect on sale of cement are discussed. In this paper authors have tried to study the supply chain issues & challenges in IndianCement industries. Situation-actor-process (SAP) –learning action performance (LAP) model has been applied for this case study. The situation represent the current situation of the cement Industry. Actors are the participants influencing the situation to evolve the different SC processes. On bases of SAP, various issues have been analyzed which will help in meeting different challenges of cement industry. Different issues & challenges effecting performance of case organization will be discussed. Reduction in logistics cost, time of delivery, production cost and transportation cost are the main benefits for Indian cement industry.

Paper No: AIPE#48

Challenges for Effective & Efficient Supply Chain Management for Fast Moving Electrical Goods (FMEG): A Case Study

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Abstract. Fast Moving Electrical Goods (FMEG) industries are amongst the most dynamic industry these days. Short product life cycle, intricate supply chain, unpredictable demand, tight profit margins are major challenges for FMEG industries. Scarcity of raw material, unpredictable delay in transportation from foreign suppliers, non-availability of affordable skilled labor, changing customer demand has completely transformed the electric goods industries. Increasing demand for good quality low cost products is giving abundant opportunities of growth to FMEG industries if the manage issues & challenges of supply chain management(SCM).In this research paper authors have studied the issues & challenges of FMEG supply chain using situation actor process –learning action performance (SAP-LAP) methodology. Authors have observed that Indian FMEG are facing challenges like supply chain collaboration (outsourcing of non-core operations, vertically integrating core competencies), retail integration, supply risk management (natural, terrorism, demand & Supply), supply chain planning (demand driven supply chains), reverse logistic, sustainability and green supply chain and digital supply chain.

Paper No: AIPE#50

Reliability Analysis of Sheet Manufacturing Unit of a Steel Industry

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Abstract. This paper deals with Reliability-Availability-Maintainability (RAM) of the sheet manufacturing system of a steel industry. The system comprises of various subsystems viz. conveyors, extractor, furnace, de-scaling unit, roughing mill, steckel mill, down coiler and strapping machine. State transition diagram has been developed which depicts various states (Fully operational/reduced capacity/failed) of the system. Chapman-Kolmogorov differential equations have been developed from this diagram using mnemonic rule. Mathematical analysis has been carried out using supplementary variable technique. Repair rate has been varied whereas failure rate has been kept constant. Mean time between failure and transient state availability of the system have been calculated using Simpson's 3/8 rule and Runge-Kutta fourth order method (using MATLAB) respectively. The conclusions drawn may be helpful to the plant management in enhancing system performance by taking accurate and timely maintenance decisions.

Paper No: AIPE#57

Wear Analysis of Al-5083 Alloy Reinforced with Chromium Oxide Filler on Air Jet Erosion Test Rig

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Abstract. Due to the operational requirements in dusty environments, there is strong need of research and development for the selection of metal matrix composites to reduce and control wear. In this regard, effects of various parameters on the wear rate should be studied to find best formulation of material and best design of machine element. This paper presents a series of preliminary experiments that are conducted to investigate erosive wear behavior of Al-5083 metal matrix composites reinforced with chromium oxide. Analysis of Variance (ANOVA) and S/N (signal-to-noise) ratios have been performed on the measured data. The findings of the result indicated that for this metal matrix composite, filler content played significant factor with regard to its influence on the wear rate.

Paper No: AIPE#70

Using System Dynamics Approach on 5S Lean Improvement Tool: - A Case Study

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Abstract. The 5S housekeeping lean tool is observed to ameliorate the systemperformance and optimize the overall productivity. The current study investigatesthe robust implications of the 1S (sorting) in the industry using the analogy ofsystem dynamics. In order to substantiate the corollary manufacturing output effectof 1S, a system dynamic approach is simulated for a manufacturing case study. The ideal intention of the system dynamic approach was to determine theoutcome of the system performance prior to the implementation, auditing, and improvisationof the 5S lean philosophy. The replication of real-life outcomes afterthe simulation is based on the fundamental variables which are versatile enoughto be applicable to other manufacturing systems that are fairly new for implementinglean practices. The current paper signifies a methodology based on asimulation that facilitates the systematic improvement, implementation and sustainingof 5S practices resulting in overall improvement of the manufacturing system.

Paper No: AIPE#79

A current review of Supply Chain Performance Measurement Systems

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Abstract. A supply chain is the network of entities (individual or organization) who work together to fulfil customer demands efficiently with maximum profits without compromising quality of product or service. Traditionally supply chains were assessed based on financial measures but increasing competition and changing scenarios. Supply chains today are assessed based on various non- financial parameters as customer satisfaction, sustainability, resilience. Performance measurement quantifies the extent up to which a supply chain is achieving its perceived objectives based on performance indicators. With diverse sectors of industry and varying goals of different supply chains, the performance indicators vary as well. The paper intends to provide a critical review on supply chain performance measurement literature by compiling key performance indicators for various sectors to understand the diversity and complication of performance measurement systems.

Paper No: AIPE#92

Mechanical Behavior of Powder Metallurgy Processed Al+ZrB2+Al2O3 Metal Matrix Composites

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Abstract. Present investigation aimed to fabricate the aluminium based metal matrix composites. Such composites play an important key role for heavy vehicle and structural applications. It can be used for light weight and more stiff components of heavy vehicles. In the present research work, an easy formation of aluminium based metal matrix composite materials are proposed through powder metallurgy process with different mass fractions of Zirconium Diboride and Alumina reinforcement such as 3% Al2O3 - 7% ZrB2, 3% Al2O3 - 5% ZrB2, 3% Al2O3- 3% ZrB2 all in the form of atomized particles. Further, microstructural readings on cross-section as well as surface of the bar and hardness measurements were attained and investigated. Improved hardness as well as tensile strength is noted from newly developed performs.

Paper No: AIPE#93

Powder Metallurgy Processing and Mechanical Characterization of Iron Based Composite Reinforced with Alumina and Zirconium diboride

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Abstract. In the present manufacturing scenario, Iron based metal matrix composites are the key requirement for heavy vehicle and structural applications. But, due problem of rapid oxidation during development of iron based composites; this field is only limited up to few research level. In the present research work, an easy formation of iron based metal matrix composite materials are proposed through powder metallurgy process with different mass fractions of Zirconium Diboride and Alumina reinforcement such as 5% Al2O3 - 10% ZrB2, 5% Al2O3 - 5% ZrB2, 10% Al2O3- 10% ZrB2 all in the form of atomized particles. Further, microstructural readings on cross-section as well as surface of the bar and hardness measurements were attained and investigated. Improved hardness as well as tensile strength is noted from newly developed performs.

Paper No: AIPE#97

Modelling the Metrics of Human Resource, Time and Asset Level Barriers in the Implementation of Lean Manufacturing using an Analytical Network Process Approach

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Abstract. A philosophy, that describes an integration of advanced tools and techniques in to the production layout of any industry for optimizing human resources, time, assets and hence overall productivity, termed as "lean" in the manufacturing or business environment. In present scenario, it is verdict that effective manufacturing environment is not fulfilled the gap between entrepreneurship and organizational demand which remains competition for further improvements in product quality under barriers. The responses appear evident that concerns are always trying to reduce wastes in operations in order to become more profitable. Therefore, an attempt has been made for implementing lean practices in organization which need commitment towards tremendous learning experience against identification and recognition of critical barriers as human resource level barriers (HLBs), time level barriers (TLBs) and asset level barriers (ALBs) which affects implementation process due to individual/employee/group level, waste time in production, infrastructures, facilities and equipment respectively. Main aim of research is to measure the effectiveness of HLBs, TLBs and ALBs using an analytical network process (ANP) framework. It is suggested that ALBs are the most critical category which impacts 43.26% , trailed by HLBs i.e 35.17% and lastly TLBs i.e 21.55% directly on implementation. Key findings of this research may strengthen the top managements and decision makers in identification and recognition of category of hindrances during implementation of Lean manufacturing on their shop floor. Also it helps them to derive suitable strategies to overcome identified barriers before implementation of Lean practices.

Paper No: AIPE#98

Modelling the Metrics of MRB, TRB and ORB in the Implementation of Green Agile Manufacturing Strategies: An ANP Approach

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Abstract. In this research work, an attempt has been made towards easy and fast adjustment to sudden change and improvements in the quality of products and customer services is known as "agility" in the manufacturing environment. Implementation of agile practices in any organization refers a tremendous commitment towards identifying and recognizing the critical barriers. Presently, certain barriers have been identified and further been categorized into Management Related Barriers (MRB), Technology Related Barriers (TRB), and Operator Related Barriers (ORB). The barriers affecting the implementation of agility due to the operators and their weak skills fall under ORB, the hindrances created due to the various technologies that are in use which restrict some of the work comes under TRB, and the problems occurring at the management level, due to the employees, are considered under MRB. The main purpose of this research is to suggest the measured effectiveness of MRB, TRB, and ORB, using an Analytical Network Process (ANP) framework. This quantified value shall help the decision makers to derive suitable strategies to overcome identified category of barriers before implementation of agile practices. The ANP framework development was carried out through identified categories of barriers with respect to certain determinants and dimensions for evaluating the impact of each category of identified barriers. Findings portray that the TRBs have maximum impact on implementation process followed by MRBs and ORBs.

Paper No: AIPE#99

Modelling and Analysis of Factors Influencing Agility in Healthcare Organisations: An ISM Approach

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Abstract. Healthcare sector effectuates agile application to upgrade services level and competitive advantage. It states utilizing expertise ideas relating numerous managing methods in obtaining a correlation between variable. The paper begins with the idea of agility in the healthcare organization; secondly, it facilitates us in finding out the factors affecting the agility in the healthcare organization; thirdly, it explicates the interrelationship among them using Interpretive Structure Modeling (ISM) technique and MICMAC analysis. Agility being imperative for healthcare organization as it helps healthcare companies reconcile more rapidly to fluctuating customer needs, competitor feedback. This study helps in the ranking of factors influencing agility in healthcare; which finally help hospitals and healthcare organization in implementing agile system efficiently and effectively.

Paper No: AIPE#100

Agile System in Health Care: Literature Review

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Abstract. The goal of this exploratory paper is to focus on the present status of implementation of the agile system in health care. In this article, analysis emphasizes the definition of agile in health care, enablers cum characteristic, implementation procedure, barriers. An inclusive research of the literature pertaining to the implementation of this system in health care was used to produce a technique to implement it. A system that is flexible in nature and enables to respond quickly to customer demand and market fluctuations while still optimizing costs and quality by adopting upgraded tools, processes and training is termed as an agile system. The agile system in health care basically offers an efficient framework to organize and govern process improvement. It can be only accomplished if a systems approach is enforced together with a proper orientation. The common implementation steps suggest conduct agile training, starts pilot projects and executing improvements using interdisciplinary teams. Lack of instructors and advisor are one of the barriers and they can furnish support by sharing their knowledge and experience and illustrating with help of an example from real-life applications of Agile in health care.

Paper No: AIPE#101

Agility Evaluation in the Rolling Industry: A Case Study

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Abstract. In the contemporary marketplace, the rate of competition is high both on local as well as global level. Rolling industries are used for manufacturing materials which are used further for developing various finished products. The products developed are in accordance to a volatile market keeping in mind cost and productivity. Thus, the manufacturing system i.e. integrated lean-agile manufacturing system (LAMS) can be adopted. However, the implementation of the integrated form of manufacturing can be difficult to accomplish. Some attributes and sub-attributes are there which besides having an impact on the implementation process. This paper's main objective is the identification and analysis of the attributes. These attributes have been determined with the help of literature review, then the rating is implemented using the questionnaire-survey and Fuzzy Agility Evaluation (FAE) approach has been utilized for the analysis of the agility level of the rolling industry.

Paper No: AIPE#102

Evaluation of Common Barriers to the Combined Lean-Green-Agile Manufacturing System By Two Way Assessment Method

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Abstract. The rapid development in the industry and ever-increasing manufacturing competitiveness around the globe has diverted industries towards the adoption of new manufacturing systems. The industries have moved from a singular manufacturing system to a combination of two of them in order to cope with the expansion of market structure and customer requirements. In today's scenario, a need for a more sustainable manufacturing system has emerged, therefore a combination of lean, green and agile manufacturing systems can provide the required results. The adoption of a Lean-Green-Agile Manufacturing System (LGAMS) in the present market scenario would be influenced by a few barriers viz. Lack of Top Management Support and Commitment, Fear, and Resistance to Organizational Change, Financial Constraints/Risk of Business etc. The barriers can be attributed to different perspectives depending on their field of influence like Economic, Technical and Organizational Perspective. An attempt has been made to prioritize the influencing nature of each barrier. Application of Analytical Hierarchy Process (AHP) would yield the required prioritization of the LGAMS barriers. This multi-criteria decision method is prone to instability due to crisp inputs. A further extension of AHP i.e. Fuzzy AHP – AHP with fuzzy inputs has been utilized. Further, a cross-check has been performed for the above results by using Two-Way Assessment Method.

Paper No: AIPE#125

Optimization the Safety Stock Cage Area

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Abstract. Safety stock cage area is the allocation of space for storing the stock and of any industry. In this study we have focused in optimizing the potential time taken and relative space required in the distribution of these parts throughout the factory, by studying the problems that arise in a stock cage area our research exploits into various options and have concluded at an integration of 2 feasible solutions :-

a) Colour coding

b) Automated storage and Retrieval system

Paper No: AIPE#141

Weld Strength Analysis of Ultrasonic Polymer Welding using Adaptive Neuro-Fuzzy Inference System

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Abstract. Polymers are widely used in automotive and aerospace industries for its better strength and easy to design the expected shape and size of parts. To join the two plastic parts, ultrasonic welding is an effective way because of fast and clean process. The present study intends to investigate the weld strength of Ultrasonic Welding (USW) for PC/ABS blend using Adaptive Neuro-Fuzzy Inference System (ANFIS). The ANFIS models are utilized for the formulation of mathematical model of USW. All the input parameters are expected to have a significant impact on the weld strength but the most influencing input parameters are pressure, weld time and amplitude are prepared for this study. By comparing the real time experimental results with the ANFIS predicted results, it is observed that the predicted and experimental models are in accordance with each other. This novel ANFIS model could be further employed for identifying the tensile strength of USW joints in various joining applications. Finally, the SEM images are analyzed to predict the nature of the weld condition.

Paper No: AIPE#159

Simulation for Effective Shop Floor Decision Making: A Case Study

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Abstract. Shop floor simulation has been recognized as useful tool to analyze the effectiveness of any decision taken by shop floor manager. The importance of simulation in shop floor control decisions making has further increased with globalization and complexity of operations. The work presents a case study of an SME unit supplying parts to a reputed automobile manufacturer in National Capital Region (NCR). The study had been undertaken to analyze possibilities of increasing production capacity with minimum increase in infrastructure. The study was conducted under various production scenarios. Simulation software WITNESS was used for this purpose. The study identified relationships between specific investments under consideration and expected throughput.

Paper No: AIPE#160

Investigation of Titanium As Thin Film Deposited Material Thereon Effect on Mechanical Properties

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Abstract. In this article state of art of research on thin film deposition and their interaction with bulk material, along with morphological changes and their behavior under different loading conditions are analyzed and hence performances is reviewed. Researchers have put significant efforts to predict changes in structural property and their influences on performances of these coatings. These coatings can exhibit adaptive and chameleon kind attributes. The physical and structural properties of the element used for coating had relationship between amorphisation, chemical structure, chemical properties and thus altering performance of coated sample. Here we selected mechanical properties as an indicator of performance measure. Material's microstructure , elastic modulus, hardness, roughness, lattice parameters etc. as a function of the deposition might be examined by SEM, TEM, XRD ,EDS, AFM etc. and analysed by tribological applications, nanomechanical measurements, nanoindentation, wear behavior, micro-abrasion. Where hardness, elastic modulus are significant for tribological applications And mechanical properties of coated thin films is measured by nanoindentation, nanomechanical measurements. Here a critical examination and review of theoretical & experimental frameworks is presented for better understanding of mechanical properties & metallurgical characteristics.

Paper No: AIPE#164

A Systematic Review: Effect of TIG and A-TIG Welding on Austenitic Stainless Steel

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Abstract. Austenitic stainless steel (ASS) plays a important role in fabrication and manufacturing of products due to its good mechanical properties and easy weldability mostly for all types of welding. In fabrication, there are numerous welding techniques available for ASS such as, gas metal arc welding, tungsten inert gas (TIG) welding, electroslag welding, submerge arc welding, electron beam, thermite welding etc. TIG welding is most common operation use for joining of two similar or dissimilar metals with heating or applying the pressure by using the filler material. TIG welding technique which is used in several industries like automobile, aerospace,marine etc. due to its quick and precise process. This paper systematically reviewed the TIG and A-TIG welding process of ASS which included several recent experimental activities. In TIG welding the inputs such as the voltage, current, filler materials and shielding gasses, the type of flux and passes which ultimately affect its output weld quality. In adition, the comparison has been provided in between TIG and A-TIG welding process parameter and their weld outcomes such as microstructure, mechanical, penetration depth, and weld bead quality etc. A-TIG has better hardness and mechanical properties than TIG welding.

Paper No: AIPE#174

Optimization of Electrical Discharge Coating of Ws2 and Cu Powder Mixture Deposited Through Green Compact Electrode

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Abstract. Electrical Discharge Coating (EDC) has been carried out to deposit the mixture of tungsten di sulfide (WS2) and Copper (Cu) powder on the mild steel surface for solid lubrication. The material deposition process takes place through green compact tool by using EDC set up inside the Die- sink Electrical Discharge Machine (EDM). The powder compact tool has been prepared in the hot mounting press for different value of powder mixing ratio i.e WS2: Cu/40:60, WS2: Cu/50:50, WS2: Cu/60:40. The coating material deposit due to series of chemical reactions between the tool and workpiece in presence of hydrocarbon oil when reverse polarity has been used in die-sinking EDM. Response surface methodology has been utilized for optimization by varying the molding press and machining input parameters such as mixing ratio, duty factor, and peak current. Reduction in micro-hardness value as a result of solid lubricant deposition has been revealed with the help of Vickers hardness testing machine. Field Emission Scanning Electron Microscope (FE-SEM) analysis has been performed to examine the presence of pores, voids, and gaps on the mild steel surface. X-ray diffraction study along with the Energy-dispersive spectroscopy (EDX) results also confirms the presence of WS2, W, S, Cuand Cu2S compounds in the coating. The effect of duty factor and peak current on different output parameters (mass transfer rate, tool wear rate, and microhardness) has been evaluated.

Paper No: AIPE#184

A Theoretical Analysis for Prioritization of Lean Strategies: A Survey of Indian Manufacturing Industries

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Abstract. The purpose of this paper is to discover the lean strategies prioritization in Indian manufacturing industries. It also aims to select the best strategy for industries. It also helps to improve the performance of implemented lean strategies. This research provides a ranking of implemented lean strategies with grey relational analysis (GRA). Evaluating data were collected from seven different industrial experts in terms of four lean performance criteria's such as cost, time, quality and flexibility. Here, fuzzy five Likert scale weighted methods is used which integrated into the GRA with respect to weight the lean performance criteria. This study provides the priority of lean strategies based on selected criteria's with using the GRA method which is very effective and result will help for decision-makers to recognize the best strategy in Indian manufacturing industries. To make results more effective, data were collected from 11 different manufacturing industries which will help in future and criteria's can be more for a better result. Moreover, as an interesting proposal, the fuzzy linguistic environment may be further incorporated into the practical as per GRA results. In distinction to preceding research, it set apart for priority based on the scores of GRA with performance criteria's. Furthermore, there is very less work available in literaturewith GRA for prioritization.

Paper No: AIPE#200

Numerical Simulation of Hot Isostatic Pressing Process Utilized During Sintering of Tool Inserts

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Abstract. Sintering is a popular technique, where powder compacts are heated in a furnace to impart strength and integrity. Usually, sintering process is a one of the essential stage followed during powder metallurgy along with powder production and powder compaction. Sinteringprocess is multistage and carried out in a partial vacuum with the controlled atmosphere to achieve required metallurgical properties. To make a product completely pore-free and dense, Hot Isostatic Pressing (HIP), a Secondary powder metallurgy operation is necessary. In hot isostatic pressing, Argon gas is used as the pressure medium and isostatically applied to the sintered part with the pressure around 100 bar with a temperature range of 500 – 2000 0C. Although the hot isostatic pressing is a well-established technology, the understanding of local details like the internal gas flow and heat flux inside the furnace will help to improve the process itself as well as to reduce the rejection rate of the sintered inserts.In this paper, numerical simulation of hot isostatic pressing is presented. As the process involves unsteady flow through porous felt as well as graphite cylinders, transient analysis of Argon flow inside the Horizontal vacuum sintering furnace is simulated. The Argon gas is passed into the furnace through an inlet at the mass flow rate of 300 litre per hour. The simulation is carried out for 1200 seconds with a time step of 0.01. Numerical results show the local temperature; pressure and flow conditions attained and eventually used for further process improvement particularly in the central zone of the furnace.

Paper No: AIPE#219

Optimization of Critical Process Parameters of Tungsten Carbide in Electro Discharge Drilling

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Abstract. In today's scenario unconventional machining processes have gained its popularity due to its ability to machine highly hard and difficult to machine materials with high accuracy, low tolerance and better surface finish at a faster rate. Electro discharge drilling is a hybrid machining process which integrates conventional drilling process and electro discharge machining. Tungsten Carbide (WC) is an extremely hard composite material having hexagonal structure which is being used in industrial machinery, cutting tools, abrasives, etc. The present study elucidates the drilling of Tungsten Carbide through Electro Discharge machining with influence of spark erosion oil (Seo25) using copper drill bit. In present investigation, L9 Taguchi approach has been adopted to conduct the experimentation and to optimize the critical process parameters Discharge current, Pulse on and off timing and Tool speed for maximum material removal rate with minimum tool wear rate and better surface finish.

Paper No: AIPE#234

Influence of the Secondary Air Pressure in the DepositionEfficiency of A Twin Wire Electric Arc Spraying

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Abstract. One of the major concerns of today's manufacturing sector is the in-crease in the cost of the materials and not able to utilize them to its fullest po-tential. This can be recovered by increasing the efficiency of the process. This paper attempts to decrease the monetary losses that are caused by insufficient deposition of tin and tin/zinc on the surface of a thin film capacitor by the pro-cess of electric arc spraying. Various modifications in the existing parameters have been put forth and amongst them, the feasible one is worked upon. Exper-imental investigation shows that the introduction of secondary passage in the air cap of the electric gun leads to more deposition of the material, thereby decreas-ing the temperature and increasing the coating thickness of the substrate. This will cater to the effective utilization of both the material as well as cost.

Paper No: AIPE#298

Fabrication & Characterization of Al2o3-Tic Reinforced Aluminium Matrix Composites

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Abstract. With the wide range of applications, AMCs (Aluminum Matrix Composites) plays an important role in many of the engineering applications and industries i.e. automobile and aerospace. AMCs are the composites having aluminum as matrix and ceramics or some other metal as reinforcement. The aim of present study is to develop the Al2O3-TiC reinforced AMCs and study the effect of reinforcements on the mechanical properties. In the present case, the Al2O3-TiC content is varying in composition of (0, 5, 10, 15 and 20 % wt.) in aluminum matrix, fabricated by stir casting technique. It is found that reinforced AMC's shows the better mechanical properties as compared to unreinforced AMCs. Various properties which were improved include tensile strength, hardness and wear resistance. It is expected the present composite will be useful for developing lightweight aerospace components

Paper No: AIPE#307

An Empirical Study of Performance Improvement in Product Delivery System through Six-Sigma DMAIC Approach

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Abstract. The paper presents key features, obstacles and shortcoming of Six-sigma method which allows an organization simply a means of measurement of quality that strives for near perfection. In industry, on the globe due to the competitive market and customer pressure struggles to sustain. Focusing on DMAIC processes with great impact on business performance, the methodology involves the static analysis of quality and quantity common variance which can be reduced by the six-sigma team. Six-sigma application in product resulted in performance improvement of 48.66%, quality improvement of 67.47%, delivery time is improved 36.63%, cost reduction is 72.02% and the marginal reduction in procurement and inventory carrying cost. Overall improvement in customer satisfaction is registered by a margin of 8%. This case study on six-sigma principle and practices will succeed by refining the organizational culture continuously.

Paper No: AIPE#322

Feature Extraction and Recognition Information System for Manufacturing Prismatic Part

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Abstract. Feature recognition systems are now widely located as a foundation for framing an automated process planning system. Various methods have been reported in the kinds of literatures, but a few of them acquired a status of generic methodology. This research aims to exploit the concept of automatic feature recognition system using CAD model neutral file in the format of ISO 10303 STEP AP-214 to identify the hole feature of the CAD model. The boundary (B-rep) geometrical information of the part design is analyzed by a feature recognition procedure that is created specifically to extract the features from the geometrical information based on a geometric reasoning approach. Finally, a sample application description for a workpiece is presented for demonstration purposes.

Paper No: AIPE#351

Development of hybrid forms of Abrasive Flow Machining Process: A review

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Abstract. In the present era the demand of products with better surface finish and quality has improved drastically which promoted the industries to make their products with better functional performance and sustainability in the market. Due to low productivity of Abrasive Flow Machining (AFM) there is a need to develop an efficient process which will inculcate a better surface finish and good quality. Hence it is required to identify various hybrids of abrasive flow machining which involve the development of new process having high material removal, optimum surface finishand better type of fixturing during the finishing operation. This paper describes about various hybrid forms of abrasive flow machining developed so far for productivity enhancement and involved parameters with their working principle.

Paper No: AIPE#355

Microstructure, Economic and Emission Evaluation of Castings Produced from Bio-Diesel Fired Self-Designed Rotary Furnace

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Abstract. In this research work, various types of furnace systems, i.e., coke-less cupola, coke-fired cupola, and biodiesel fired self-designed rotary furnace have been utilized for the economic analysis of the produced castings. In the comparison of other furnaces, the results of regressive experimentation on the self-designed and fabricated rotary furnace found the saving of around 5.8% in the cost of the casting. The microstructure and mechanical properties analysis was also performed to check the quality of the produced castings with the self- designed rotary furnace. In addition, the emission levels were found to be within the specified limits given by CPCB norms.

Paper No: AIPE#380

Tribological Properties of Graphite Reinforced Composites

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Abstract. The current research work scrutinizes aluminium alloy 6101-graphite composites for their mechanical and tribological behaviour in dry sliding environments. The orthodox liquid casting technique had been used for the manufacturing of composite materials and imperiled to T6 heat treatment. The content of reinforcement particles was taken as 0, 3, 6, 9 and 12 Wt. % of graphite to ascertain it's prospective as self-lubricating reinforcement in sliding wear environments. Hardness, tensile strength and flexural strength of cast Al6101 metal matrix and manufactured composites were evaluated. Hardness, tensile strength and flexural strength decreases with increasing volume fraction of graphite reinforcement as compared to cast Al6101 metal matrix. Wear tests were performed on pin on disc apparatus to assess the tribological behaviour of composites and to determine the optimum volume fraction of graphite for its minimum wear rate. Wear rate reduces with increase in graphite volume fraction and minimum wear rate was attained at 3 Wt. % graphite. The average co-efficient of friction also reduces with graphite addition and its minimum value was found to be at 3 Wt. % graphite.

Paper No: AIPE#384

A Critical Review on Friction Stir Welding of Dissimilar Aluminium Alloys

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Abstract. Friction Stir Welding (FSW) is a solid state joining process having capability of joining materials which differ in chemical composition, properties, etc., and where fusion can lead to harmful reactions. Nowadays the arena of aerospace, railway, ship building industries, etc., are moving towards the use of this technique as compared to fusion welding process for fabrication of structural parts. It is energy efficient, eco- friendly and versatile process of joining. In the current study an attempt has been made to study the effect of process parameters i.e. rotational speed, welding speed, tool tilt angle, dwell time, etc., on the weld characteristics of dissimilar aluminium alloys. Moreover, difficulties and other issue related to FSW of dissimilar metals are addressed to provide guidelines to research community to carry out extensive research in this field.

Paper No: AIPE#385

Analysis of Green Supply Chain Management Enablers in FMCG Sector Using Integrated ISM and MICMAC Approach

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Abstract. The objective of this paper is to identify and model the relationship amongst various Green Supply Chain Management (GSCM) enablers encountered while implementing GSCM practices in Fast Moving Consumer Goods (FMCG) industry. 11 key enablers were identified and Interpretive Structure Modeling (ISM) is used to construct a model describing mutual relationship amongst various enablers. Matriced' Impacts Croise´s Multiplication Applique´ea´ un Classement (MICMAC) analysis ia conducted to give results regarding driving and dependence power of enablers. The results of this study can be considered by the top management while formulating strategies for implementation of GSCM practices in their respective organization.

Paper No: AIPE#388

StudyofSlidingWearBehaviorofAluminaOxideFilled Fiber Composite Using Design of Experiment

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Abstract. The carbon fiber reinforced polymer composites are extensively used in different manufacturing applications due to their superior strength to weight, high thermal stability and excellent corrosion resistance. The main objective of present research work is to optimize the sliding wear conditions (applied load, sliding velocity, and %wt Al2O3particulates) for minimum wear volume of Al2O3filled carbon reinforcement fiber composites against EN-32 steel. Taguchi based L9 orthogonal array and ANOVA is used to find the optimum parameters for minimum wear. The sliding velocity has been found most significant parameter that affects the sliding wearfollowedbyfillerloadingand normalload. Ontheotherhand,ithasbeenfoundthatslidingwear rate continuously decreases with increase in filler loading and increases with increase in applied normal load and sliding velocity.

Paper No: AIPE#391

Deformation Behavior of Semi-solid forged A356-5TiB2 Nano in-situ Composites

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Abstract. The research work investigates the application of Semi-solid metal processing (SSMP) to predict the deformation behavior of semi-solid A356-5TiB2 Nano in-situ composites. The semi-solid forging of A356-5TiB2 in-situ composites was carried out in three steps. In the first step, Cooling slope (CS) casting setup was developed to generate the non-dendritic feedstock of the composites for subsequent thixoforging. In the second step, differential thermal analysis was used to estimate the semi-solid temperature range in order to achieve partial remelting temperatures and solid fraction profiles of the composites. In the final step, the non-dendritic feedstock of the composites was thixoforged with different % reductions ranging from 30 % to 50 %. It is noted that the semi-solid A356-5TiB2 Nano in-situ composites with 40% deformation attained the tensile strength (UTS) of 318 MPa, in peak aged condition which is about 110.6% compared to gravity cast alloy. This is attributed due to the presence of Nano TiB2 particles in the semi-solid forged A356-5TiB2in-situ composite, which clearly indicates the influence of semi-solid forging on the deformation behavior and tensile properties of composites.

Paper No: AIPE#392

Study of MRR and TWR in Electric Discharge Machining of AISI D2 Tool Steel

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Abstract. Owing to its mechanical and metallurgical properties, AISI D2 is extensively used as tool steel in die making industry. Typical shapes and intricate die cavities along with its high hardness make conventional operations of machining unsuitable and uneconomical for machining of AISI D2 steel. Electrical discharge machining (EDM) is an appropriate process for machining of such high strength tool steels. Therefore, this study was carried out to characterize and optimize the process parameters of die-sinking EDM for material removal rate (MRR) and tool wear rate (TWR) in machining of AISI D2 tool steel. Discharge current, gap voltage, pulse-on-time and tool material were taken as process parameters. Taguchi's orthogonal array approach coupled with analysis of variance is applied to design the experiments and analyze the relationship between process parameters and process outcomes. Methodology developed in this study assists in adjusting machining parameters for desired outcomes. Moreover, the process parameters can be utilized to economically manufacture the quality die tools.

Paper No: AIPE#433

Role of Acoustic Softening Effects in Ultrasonic Spot Welded Dissimilar Materials

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Abstract. Ultrasonic spot welding (USW) is a rapid solid state welding process in which thin sheets are joined under the influence of high-frequency ultrasonic vibration and pressure. USW has several advantages over conventional fusion welding processes such as less energy consumption, no use of flux or filler material and generation of temperature below the melting point of parent materials. Experimental results have confirmed that USW is a combination of both thermal and acoustic softening effects. These two facts are essential for plastic deformation and bond formation during the welding process. In the present work, an attempt has been made to develop a novel thermomechanical model to characterize thermal and acoustic softening in AA1100 sheets. Experimental temperatures and increment in a width of the sheet are considered to quantify the amount of acoustic softening for different surface conditions. Acoustic softening confers a maximum reduction of 93.98% in yield strength of AA1100 sheets. This model provides a new approach to understand this complex bonding process in a very effective way.

Paper No: AIPE#448

Optimization of Quality and Productivity of Wire EDM by using L9 Orthogonal Array

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Abstract. Quality and productivity are two essential facets have developed in present competitive global market. In the present study of Wire EDM Process of AISI P20 tool steel to optimize the quality as well as productivity simultaneously. MRR in the terms of Productivity, this can be maximized and Overcut in terms of quality that can be minimized. This study to highlight AISI P20 tool steel in which the best combination of machining parameters setting with Taguchi design of experimental technique, of WIRE EDM. The selected input parameters are pulse-on time (Ton), wire feed (f) and pulse-off time (Toff). The objective of this paper is to achieve the maximum MRR and the minimum Overcut. They used copper wire of 0.25mm diameter as a tool and dielectric fluid was used in distilled water, L9 orthogonal array based on Taguchi design has been used. These two responses (MRR and Overcut) have been converted into signal quality characteristics for optimal process environment (optimum input parameters setting). Principal component analysis (PCA) combined with based grey relation analysis (GRA) with Taguchi design of experiment techniques has been used and solve the problem.

Paper No: AIPE#449

Enhanced Fluorescence-Based Detection of Vibrio Cells over Nanoporous Silica Substrate

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Abstract. The food and waterborne pathogens threaten the human health through porous borders that require immediate detection in real time. The present work reports the development of a nanoporous silica-based platform for the rapid detection of Vibrio cells. The nanoporous thin film has been developed over silicon substrate utilizing PMSSQ (polymethylsilsesquioxane, (CH3SiO1.5)n) and PPG (polypropylene glycol, CH((CH3)CH2O)n) combination in PGMEA (Propylene glycol methyl ether acetate) solvent as provided earlier by Gangopadhyay et. al.[1]. The PPG acts as a porogen; and evaporates on heat treatment giving a porous structure and assembles the PMSSQ nanoparticles. The films were characterized through FTIR, EDAX, and SEM microscopy and it was found out that the functional groups like OH, CH3, Si-CH3, Si-O and Si-O-Si were present abundantly in the porous structure, which can be further modified for its application in biology. An aliquot of 2.5 µl Vibrio cell solution was immobilized (over nano-porous silica film) to study its fluorescence intensity under an epi-fluorescence microscope. Vibrio (Vibrio harveyi (ATCC® 700106™)) cells possess self-fluorescing effects with bleaching characteristics. The fluorescence images (with the progression of time) are acquired and processed through Image-J (Courtesy-NIH) and relative fluorescence of the cells are calculated as a function of time. A 1.7 times increase in the overall fluorescence intensity level is recorded in presence of the porous silica layer as compared to uncoated silicon substrate showing immobilization capabilities of these films.

Paper No: Aipe#455

Identification of The Needs and Steps Required for Expansion of A Car Safety Equipment's Manufacturing Plant

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Abstract. Advancements in vehicle safety technologies have had a major impact on the reduction of road related accidents and fatalities. Thus, it's important to have a well optimized and efficient car safety equipment manufacturing plant which will result in manufacturing safety equipment with good quality and ensure reduction of road related accidents and safety concerns for drivers, passengers and indeed all road users alike. This paper particularly focuses on the identification of the steps required for the expansion of a car safety equipment's manufacturing plant. The research is based on a case study of the company Autoliv Inc. and their products, which mainly include production of Air bag, Steering Wheel and Seat Belts , the process for identification and need for expansion is realized in the form of risk optimization, internal workshops for identification of volume and space allotment for various car safety equipment's and for all departments of the Autoliv plant found out by using value stream mapping (VSM), selection of a developer, comparing of different layouts of plots by various developers which is then used to study it's theoretical application to real world scenarios, process to calculate the internal costings of the plant. The process includes the study of the safety attitudes of workers, supervisors, and managers in an Autoliv plant, and their relationship with unsafe behavior and accidents. This study will help foster an understanding about various processes required for a car safety equipment's manufacturing plant's expansion about certain parameters and their different impacts in regions of the world that requires different approach when trying to realistically reduce the consistent destructive trend of accidents and fatalities.

Paper No: AIPE#456

Evaluation of Key Challenges to Industry 4.0 in Indian Context: A Dematel Approach

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Abstract. The rapid development of information technology, analytics, computing capacity, and hardware has led to increasing affinity towards the concept of Industry 4.0. Industry 4.0 uses cyber-physical systems (CPS), Industrial Internet of Things (IIoT) and cloud data sharing to develop intelligent manufacturing systems. The Indian industries under the patronage of national and local government initiatives like Make in India and Digital India are looking forward to adopting best in class manufacturing infrastructure to support the changing industrial environment and utilize the immense opportunities ahead. For this purpose, Industry 4.0 will play a vital role in achieving manufacturing competitiveness. This paper is an attempt to evaluate the key challenges of Industry 4.0 in the Indian context. A Decision-Making Trial and Evaluation Laboratory (DEMATEL) approach is used to establish relations between the key challenges.

Paper No: AIPE#476

AHP Based Model for Evaluation of Sustainable Manufacturing Enablers in Indian Manufacturing Companies

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Abstract. In the present scenario, the success of an industry depends on its sustainable manufacturing performance where competitiveness is followed by superior performance. To remain competitive in the market, the manufacturing companies need to evaluate their performance through the manufacturing sustainability. This paper presets an AHP-based model for enablers of sustainable manufacturing evaluation in Indian manufacturing Companies. A hierarchy structure is established based on the proposed key enablers of sustainable. The company's score is calculated to assess sustainability in manufacturing against the enablers and the companies rank is determined based on their scores.

Paper No: AIPE#481

Development of Hydrophobic Coating with Polymer-Metal Oxide Nano-Composites

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Abstract. In this present study investigated the hydrophobicity of the nano-coating developed with TiO2 and SiO2-TiO2 nanoparticles in organic binder, where polyurethane was taken as model binder. Core SiO2 nanoparticles have been synthesized using stober method with average particle size of 92 nm. TiO2 and nano core@shell have been prepared using peptization process. Particle size were measured as 75 nm for TiO2 and 144 nm for nanoparticles of core shell were prepared using peptization process. In this process hydrophobic titania was produced at 700C. Here SiO2-TiO2 core-shell nanoparticle was synthesized because core silica improves the mechanical strength and shell TiO2 on core silica provides the hydrophobicity of the coating surface. Characterization of these nanoparticles were performed by UV-vis spectrophotometer, dynamic light scattering (DLS), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and XRD. The coating on the surfaces were developed with the aforementioned nanoparticles separately and concentration of nanoparticles were varied from 1wt % to 6wt %. The best performance was obtained in terms of hydrophobicity with 4wt % of concentration of nanoparticles in polyurethane coating system. In this work, prepared coatings were developed on glass substrate (20×20×10 mm) using a brush, dried in oven at 80ºC for 15 minutes, on drying 100µm thick film was obtained. Static Contact angle of water droplet on these dried films were measured and obtained as 129º for PU film containing TiO2 nanoparticle and 133.3º for PU film with SiO2-TiO2 core@shell nanoparticle.

Paper No: AIPE#486

Mechanical Properties of Flax Fibre Reinforced Composites Manufactured using Hand Layup and Compression Molding – A Comparison

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Abstract. The focus of the researchers has been shifted towards natural fiber reinforced composites due to their biodegradability and environmental compatibility. These composites can be made by traditional hand layup process or can be manufactured with the help of machines, out of which compression molding is a versatile and efficient method. In this paper, hand layup method and compression moulding method are compared to find out the optimal process for fabrication. For optimizing the fabrication parameters, tensile strength under various fabrication conditions was found. The compression pressure was varied from 2 to 10 MPa and the optimum result was found for 4 MPa. On the other hand, 100oC resulted in ideal properties, when the specimen was fabricated under different temperatures. Three different volume fraction of fiber was also evaluated and 0.27% volume fraction exhibited the optimal performance.Further, the effect of post-curing on tensile and thermal properties was studied. The influence of various parameters in compression moulding was also investigated.

Paper No: AIPE#493

Design and Development of an Online Process Measurement System for Zero Defect Production

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Abstract. The objective of the scheme presented in this paper is to fabricate a system for press line that allows for real-time sorting of parts with defects caused by process variation. Despite high investment and advanced technology, defects like thinning, cracks and wrinkles are still common in products in the sheet metal forming industries. Variation of the process parameter is an unavoidable reality resulting in heavy investment in process control technologies like adaptive control and closed loop systems. The limitations of a control system mandate an inspection line post-production. With this scheme, the dependence of product quality on the effectiveness of the inspection line can be reduced.The project that was undertaken herein mainly focuses on design and fabrication of online inspection measurement system which is used to monitor the process parameters - alignment, uneven force distribution and non-uniform pneumatic pressure. Comparison of real-time values is done with ideal value of process parameters to check variation of values in the press line. The readings on GUI of MATLAB show the exact parameters of the system at particular instants through which estimation of the reason for defect and an exact number of defective pieces can be found. The experiments affirmed the importance of process parameters in the consistency of quality through the feedback from sensors. The scheme can successfully reduce both producer and consumer risk. Savings in space, time, manpower, and capital in inspection system can also be achieved.

Paper No: AIPE#498

Recent Developments in Fabrication of Super-Hydrophobic Surfaces: A Review

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Abstract. Nature has many biological structures with water-repellency phenomena depicting super-hydrophobicity which are observed in various plants, insects, and animals. The advancements in the broad area of biomimetics provide scope towards development and fabrication of nanotextured surfaces. With biological design replicating adaptation and derivation from various natural environments is referred to as “biomimetics”. Related to exceptional properties of super-hydrophobicity, researchers have recently developed and fabricated biomimeticnanotextured super-hydrophobic materials. Surface modification to prepare chemically and physically textured super-hydrophobic metallic surfaces with a standard protocol so that repeatable and well-characterized surfaces can be obtained with a high contact angle, low contact angle hysteresis, bounce and proper roll-off rate. A review-based approach is provided in this paper with developments in surface modification and fabrication of super-hydrophobic materials by various nanotextured processes.

Paper No: AIPE#500

Supplier Service Quality in Indian SMEs: A Dual Directional Customer Perspective

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Abstract.This paper investigates the role played by service quality at supplier-manufacturer dyad in small-medium manufacturing units, and presents a model to establish that contribution of both the supplier and manufacturer towards service quality leads to satisfaction followed by loyalty. The research design for this study includes a combination of literature survey, exploratory interviews with practitioners, and a questionnaire survey conducted through interview schedule from 120 respondents working in different small-medium manufacturing units of North India. Structural equation modeling (SEM) has been used for data analysis. The paper has developed dual directional scales to evaluate service quality at supplier-manufacturer dyad and tested a set of four propositions. A model showing linkages of manufacturer (manufacturing unit's) service quality with supplier service quality leading to satisfaction and loyalty is also developed. The model is empirically tested and is found to be fit. This study would be of interest to SME managers particularly engaged in 'purchase' function and researchers working on inter-firm supply chains in such units. This study recommends forming strong collaborative relationships with suppliers to achieve a win-win situation.

Paper No: AIPE#506

Conceptual Analysis of Reliability Aspect for Various Process Industries: A Critical Review

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Abstract. The reliability engineering field has undergone evolutionary development and burst through during the last four decades. This paper presents a historical outlook of momentous developments and methodically enumerates the contributions in the field of reliability engineering since the commencement. This paper further looks into the significance and advancement of various numerical methods for reliability analysis, diagrammatical models, logical methods and other reliability tools and techniques that have fashioned the emergence of reliability engineering. Higher productivity and maximum profitability has nowadays become very essential for the processing industries to ensure their survival. To meet this challenge, all the systems and subsystems of these industries should have high reliability and availability. If the manufacturing systems are of improved quality and are having high availability level, this will definitely lead to enhancement of productivity and hence profitability. It has been realized that reliability and availability has great importance in all the processing industries and complex plants. Reliability concept is of great importance at design stage, development stage, procurement stage, operation stage and maintenance stage. The study has been undertaken by many researchers in order to understand the performance behavior of the systems in various process industries. A critical review has been conducted to present the brief overview of performance behavior and optimization of different systems related to various process industries. Finally, this paper highlights limitations with existing reliability analysis methods and identifies a few potential opportunities for further research.

Paper No: AIPE#515

Estimation of Hardness During Heat Treatment of EN8 and C25 Steels

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Abstract. The hardness of EN8 and C25 steels during Jominy type end quench test were numerically estimated. The cooling curve near the quenched end of the specimen was used to estimate the heat flux during quenching. Heat transfer in the specimen during quenching was modeled as a 2D axisymmetric heat conduction coupled with austenite decomposition. The relevant equations were solved inversely for the heat flux with cooling data as input. The microstructure distribution within the specimen were computed and a hardness model developed based on microstructure distribution. The measured hardness values were compared with the estimated hardness values. The predicted and experimentally determined hardness along the length of the specimen have been shown to be in good agreement within ± 3 HRC/HRB.

Paper No: AIPE#517

Parametric Investigation into Alumina Nano Powder Mixed Edm of Inconel 825 Alloy Using Rsm

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Abstract. Nano powder mixed Electrical discharge machining (NPMEDM) is a recent development in the non-traditional machining process. In this process, addition of powder into dielectric increases the spark gap between the electrodes resulting in more number of low intense sparks. Therefore, both the Material removal rate (MRR) and surface finish improve. The present work investigates the effect of Al2O3 nano powder mixed EDM oil on various responses like MRR and Surface Roughness (SR). The Al2O3 nano powder is mixed with EDM oil at a concentration of 0.5 g/L. Pulse duration (Ton), peak current (IP), gap voltage (GV) are taken as the process parameters. The experiment is designed using response surface methodology (RSM), where two sets of experiments have been conducted using two different dielectric conditions (i.e. EDM oil and powder mixed in EDM oil). Analysis of variance (ANOVA) shows that all the three selected parameters are significant for MRR and SR. The study shows that there is considerable improvement in MRR, SR after mixing Al2O3 nano powder in EDM oil. Using Field Emission Scanning Electron Microscope (FESEM) a detailed study on the surface integrity of the machined surface has been carried out. It has been found that NPMEDM reduced micro-cracks, micro-holes, uneven deposit and recast layer thickness of the machined surface to a great extent.

Paper No: AIPE#522

Plumbene: A new 2D-Material Resembling Graphene

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Abstract. Over two decades two dimensional materials attracted attention of researches due to their superior mechanical and thermal properties. Plumbenethe new two dimensional materials is a single layer of lead atoms hexagonally arranged like honeycomb structure. It already has application as a topological insulator. In this paper, we will compare between structure and properties of graphene, silicene and plumbene for application of plumbene in batteries, machine manufacturing, shipbuilding etc.

Paper No: AIPE#524

Eco Design Approaches for Developing Eco-Friendly Products: A Review

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Abstract. Producing eco-friendly products has become the need of the present due to the alarming conditions of global warming issues and depletion of natural resources. These issues have forced the industries to adopt the eco-design strategies in their production processes. Eco-design approaches are used by the designers to deal with these issues not only in the development of eco-friendly products but also in the development of sustainable buildings, Eco-industrial parks and services. Efficient integration of the eco-design approaches in product development is still under question due to the uncertainties involved in the eco-design methods. This study provides an insight into the various eco-design methods and tools available for developing eco-friendly products. Different challenges and barriers to the implementation of eco-design have also been reported in this study. Further, the uncertainties associated with the implementation of the eco-design methods are discussed.

Paper No: AIPE#530

Performance and Combustion Characteristics of Thumba and Argemone as Dual Fuel Blends in a DI CI Engine: An Experimental Approach

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Abstract. Dependence on import and concerns of continuous growth in the cost of imported fuels, because of insufficiency of petroleum resources have created an essential need for investigators to start exploring and analyse the alternate resources of energy as a fuel for IC engines which can be generated from various easily available resources like vegetable oil, animal fats, waste cooking oil etc. This is an experimental approach made to determine the performance and combustion characteristics of Thumba oil (Citrullus Colocyntis) and Argemone Mexicana as dual biodiesel blends. The tests were conducted on a single cylinder, four-stroke, Direct Injection, Compression ignition engine. In this investigation, the analysis of various parameters like average cylinder pressure, Net heat release rate (HRR), Brake thermal efficiency (BTE) and Mechanical efficiency was carried out by changing required operating conditions. The results obtained from the experimental investigation settles on a conclusion that average cylinder pressure for a heavier dual blend of biodiesel D60T20A20 (i.e., Diesel 60%, Thumba 20%, Argemone 20% by vol) is greater than that of diesel fuel by 1.7%. The HRR for lighter dual blend D90T5A5 (i.e., Diesel 90%, Thumba 5%, Argemone 5% by vol) is found to be 11.67% greater than that of diesel. Also, for almost every blend of Thumba and Argemone, there is a decline in BTE and mechanical efficiency than diesel.

Paper No: AIPE#538

Biogeographical and Variable Neighborhood Search Algorithm for Optimization of Flexible Job Shop Scheduling

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Abstract. In the past two decades, numerous techniques have been proposed by researchers across the world to deal with combinatorial optimization problems. The majority of techniques are working on nature inspired phenomena such as genetic seriatim of human beings, the way of ant colonizing, and the manners of fish and bees etc. The biogeography is a nature inspired population-based algorithm, which works on the concept of migration policy of animals. The working concept and definitions of biogeography is like the genetic algorithm, except the absence of reproduction phase in it. The migration operators have been designed to suit the current problem domain and these have been used to solve the optimization problems. In the present work, biogeography algorithm has been used with variable neighborhood search method to enhance the local search during optimization of the flexible job shop scheduling problem. This hybrid approach is proposed to measure the makespan performance.

Paper No: AIPE#555

Performance Study of Gas Assisted Electric Discharge Machining on Carbon-Chromium Die Steel

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Abstract. The present study focuses on studying the effect of liquid cum gas as dielectric during Electric Discharge Machining (EDM) of carbon chromium die steel. In this work, a hybrid process of EDM employing both liquid (commercial kerosene oil) and gas (compressed helium gas) as dielectrics in die-sinking EDM has been explored. Experimentation has been done to the study effect of process factors like discharge current, pulse on time, duty cycle, tool rotation and discharge gas pressure on material removal rate (MRR), electrode wear ratio (EWR) and surface roughness (SR). Further, a comparative study of conventional EDM with liquid dielectric and hybrid EDM with liquid cum gaseous dielectric has been performed. It has been found that high MRR, low EWR and low SR are obtained when liquid-cum-gaseous dielectric was used as compared to conventional EDM with liquid dielectric. Analysis of surface morphology reveals that the formation of recast layer and surface cracks are less on specimen machined with liquid cum gaseous dielectric with respect to specimen machined with conventional liquid dielectric. The results show that the use of compressed helium gas has a positive impact on the machining performance. Superior surface finish and higher MRR reveal the possible implementation of the process in modern machining.

Paper No: AIPE#560

Effects of Welding Parameters in Friction Stir Welding of Stainless Steel and Aluminum

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Abstract. Joining of dissimilar materials (DMs) is the growing demand of various industries to attain distinct features of individual material. In this regard, Friction stir welding (FSW) has emerged as a unique joining method to weld DMs among various joining techniques. FSW is a solid state welding process used to join similar and DMs. In this study, DMs AA7475-T761 aluminum alloy (AA) and AISI 304 stainless steel (SS) are joined using FSW. These DMs are widely lap welded in industries such as space shuttles and aerospace. Friction stir welded (FSWed) half lap joints are obtained and analyzed under three different tool rotation speeds 450 rpm, 560 rpm and 710 rpm. The joint quality is analyzed by tensile strength and microstructure. The improper heat generation at different tool rotation speeds, affected joint quality considerably. The defects such as tunneling and void were observed which resulted poor efficiency of joints. The joint efficiency was obtained maximum 62.83% of the base material (BM) AA 7475 at rotational speed 560 rpm with 6.89 percent elongation.

Paper No: AIPE#562

Optimization of FSW Process Parameters during Joining of Al to Cu using Taguchi Based GA

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Abstract. Friction Stir Welding (FSW) is new and effective solid state joining process and getting evolved to join the dissimilar materials such as aluminium (Al) and copper (Cu). FSW tool design, geometry and FSW process parameters possess a considerable impact on the material movement and stirring during joining and govern the microstructure and mechanical properties of the joints. In the present study, the effect of combination of different process parameters, i.e., shoulder diameter (A), welding speed (B) and rotational speed (C) on the ultimate tensile strength (UTS) during joining of Al-6101 and pure copper has been studied. The joining is performed using the cylindrical tool pin, and the Taguchi's L9 standard orthogonal array for three process parameters each at three levels are chosen to perform the experimentation. The optimal combination of the FSW parameters yielding maximum UTS is determined using the ANOM (Analysis of Mean), and the significance of each parameter on the UTS is ascertained through ANOVA (Analysis of Variance). It is observed that the UTS of the FSWed joints varied significantly within the selected process parameter range. Further, the observed results were verified by applying genetic algorithm (GA) using the MATLAB software.

Paper No: AIPE#566

Analysis of lean Manufacturing Implementation in SME's: A "5S" Technique

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Abstract. The aim of this paper is to analyze the implementation of 5S technique on Indian SME's to maximize efficiency in the workplace and to have the possibility of product diversification, higher quality, lower cost, reliable deliveries etc. 5S is a basic tool of lean manufacturing system. It is a tool of classification, order, cleaning, standardization and discipline. Findings of this research can be stated that the introduction of 5S technique for the improvement of SME's in its process flow line, cost reduction, machine efficiency improvement, well organized tools placement, shop floor cleanliness and high quality workplace are the identified key parameters to be optimized.

Paper No: AIPE#568

Case Study of Critical Success Factors Affecting Knowledge Management in Small and Medium Sized Enterprises in Developing State: Steel Sector

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Abstract. The Small and Medium-sized Enterprises (SMEs) need to compete with many other established organizations. Knowledge Management (KM) may be the appropriate strategic tool for businesses to compete with the other established organizations. So there is a need of the adopting the knowledge management in SMEs to compete the competitors and satisfying the customer. But in this stage adoption of KM is a very tedious task for an organization. The objective of this study to present a better way by implementing the KM in an organization and do something better for the organization for the improvement of customer satisfaction and increase competitive level as well. In this study, the present scenario of SMEs Chhattisgarh state is taken under consideration. In this study, the factors affecting the knowledge management for SMEs mainly in steel sector organization has been focused and decided a critical success factor affecting the industries by previous literature. After identification of the critical success factors from previous literature some factors which affect the steel sector most are considered. To test the reliability of the questionnaire Cronbach Alpha has been used by SPSS software.

Paper No: AIPE#569

Analyzing Success Factors of Small & Medium Enterprises (SMEs): A Study in Indian Context

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Abstract. The importance of Small & Medium Enterprises (SMEs) is recognized in the academic and policy literature. Entrepreneurship & SMEs are integral to economic and social development and regeneration. It is recognized that, SMEs are the engine of economic growth through employment generation, contribution to GDP, technological innovations, and other aspects of economic and social development. With this in consideration, the objective of this research is to identify the Success Factors (SFs) for Small &Medium Enterprises in Chhattisgarh, India. Based on the literature review, 28 factors have been identified and subsequently categorized into three groups, namely entrepreneurial & enterprise factors, motivational factors and managerial & environmental factors. Analyzing identified Success Factors in the present study shows that need for achievement under motivational factor, education level & financial resources under entrepreneur and enterprise factor, managerial capability & Government support under managerial & environmental factors are the important Success Factors (SFs) for the development of entrepreneurship through SMEs in Chhattisgarh region of India.

Paper No: AIPE#579

A Brief Review on Different Lubricants Used in MQL Process during Hard Turning

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Abstract. Heat generation in hard turning exhibits delamination of cutting tool edge rapidly, as a result the quality of finished job got deteriorates. However, now a days, various alternative cooling techniques/ different cutting fluids are utilized to minimize the cutting heat during machining action. Some sever diverse effects of use of coolants in machining creates the challenges for researchers to choose environment friendly coolant. Quality as well as economic concerns is also very important for selection of cooling technique as well as cutting fluid. In recent years, Minimum Quality Lubrication (MQL) technique provides very impressive cooling during hard machining. The MQL approach leads towards manufacturing sustainability and green manufacturing for enhancing cooling as well as the lubrication system. In MQL, a mixture of cutting fluid and compressed air is sprayed in to the cutting zone which minimizes the heat during machining. MQL attribute lower fluid consumption with flow rate may vary from 5 ml/hr to 100 ml/hr. However MQL comes under near to dry machining. In literatures, various categories of coolant like vegetable oil, castor oil, oil with suspension of nano particles etc. were found. However, with proper selection of cutting parameters along with lubricant through MQL can attributes enhanced machinability.

Paper No: AIPE#585

Applicability of Lean Six Sigma in Hospitals

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Abstract. Most of previous researches on lean six sigma focused on various perspective of six sigma, lean philosophy then role of lean six sigma in sustainability but never paid much attention in field of health service sector e.g. hospital. This article concentrates on checking feasibility of six sigma in hospitals. Defects and loopholes in hospital and healthcare industries can sentence a difference between a life and death. Since to mitigate mishaps and increase patient experiences during the visit of hospitals, this research is an extreme effort to reduce variation in service quality using quality management tool Lean Six Sigma (LSS) in registration counter at hospitals. Data-driven methodology approach and applicability of LSS in service sector encompasses not only the people but information and resource utilization. This is a mainstream pillar to be used as a methodology for research. DMAIC tool was found useful to enhance service quality during the study. Improvisation of outcomes is comparatively discussed in a chronological sense for ease of understanding. This research work will contribute to academia as well as service sectors like hospitals restaurants, banks etc.

Paper No: AIPE#586

A Comprehensive Review on Jute Fiber Reinforced Composites

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Abstract. Natural fiber composite is the noval materials in recent decades having a high strength to weight ratio and light in weight are widely used for structural and unstructured applications. Jute fiber is the one of the most common biodegradable natural fiber which successfully replaced the synthetic fibers composite and also replaced glass fiber where the high strength is not obliged. Jute Fiber Composite has several attractive advantages over synthetic and glass fiber like as low processing cost, low density, stiffness easily available, excellent mechanical properties and low production energy required (2% of glass fiber). This advantage makes the jute a very attractive reinforced fiber for composites. This paper presented an overview on different fabrication techniques and the effects of the various factors on the mechanical properties of the jute fiber reinforced composite.

Paper No: AIPE#598

Optimization by AHP-ARAS of EDM Process Parameters on Machining AA7050-10%B4C Composite

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Abstract. The present paper aims to develop AA7050/B_4C composite by stir casting method. The flux K_2TiF_6 has been used for proper incorporation of the B_4C particle in the molten matrix. The microstructures of the casted composite were analyzed with FE-SEM. The microstructure shows the proper distribution of B_4C particle with the formation of encapsulating layers of Ti compounds around B_4C particles. Machining of AA7050/B_4C composite was done by the non-traditional machining process known as Electro-discharge machine (EDM). Multi-Criteria Decision Making (MCDM) model of AHP-ARAS have been used to evaluate the optimal EDM process parameters for machining AA7050-B_4C Composite. Taguchi L_9 orthogonal array were used to design the experiments. The process parameters selected for the experiments were pulse current (I_p), pulse on time (T_{on}) and pulse off time (T_{off}) for the responses like material removal rate (MRR), the surface roughness (R_a) and depth of cut (DC). The sensitivity analysis has been used to understand the consistency of the responses by interchanging the weights of the criterion. It has been observed that the process parameters of 9th experiment were the most effective among all selected alternatives. The sensitivity analysis confirmed that the proposed AHP-ARAS model was consistent and can be used to evaluate the performance of EDM process parameters.

Paper No: AIPE#602

Sustainable Machining Using Hybrid Nano fluids Under Minimum Quantity Lubrication(MQL)

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Abstract. Over the last couple of decades nano fluids have found tremendous scope as a potential heat transfer fluid. One prospective application is in sustainable machining method with Minimum Quantity Lubrication (MQL). The use of a nano cutting fluid in machining under MQL conditions substantially reduces the amount of cutting fluid being used as compared to conventional methods. The overall performance of machining process also gets enhanced resulting in increased surface finish and reduced cutting temperature, tool wear and cutting forces. Moreover, by replacing a nano cutting fluid with a hybrid nano cutting fluid the performance of MQL is found to be further enhanced. A hybrid nano cutting fluid is composed by dispersing two or more nano particles of different materials in the conventional cutting fluid. This paper reviews the recent progress on the application of hybrid nano fluid in the machining process. Preparation methods and various thermo physical properties of hybrid nano fluids affecting the machining performance are also discussed.

Paper No: AIPE#619

Informal Investigation of Fourth Party and Third-Party Logistics Service Providers in Terms of Indian Context: An AHP Approach

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Abstract. This research is based on the investigation of Logistics Service Providers (LSPs) in terms of their activities and role in providing boons to the primary Industries and to the customer terminus. This study also reports about the futuristic ambit of "collaboration of outsourced partners, their substructure, maneuvering to gain man power, integration of LSPs." The goal of this paper is to understand the leeway of betterment of Indian Industries with the maximum utilization of LSPs, present in the current market. Alliances of LSPs will contribute in maintaining the competence strength of Indian Industries in the Global market. To achieve the best results and the benefit of above mentioned points, this research work has found out Three major criteria and their sub-criteria with the help of literature study and with the support of survey amongst the experts and Analytical Hierarchy Process (AHP) technique, output has been achieved. AHP tool helps in decision making and validation of priorities between different factors.

Paper No: AIPE#625

Detection of Punch Wear in Stamping Process Using Acoustic Emission

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Abstract. Stamping process is widely used for the production of sheet metal components because of its high productivity and accuracy. The performance of stamping depends on the condition of punch and die. Variation in punch and die dimension have a significantinfluence on the product quality. The purpose of the present study is to identify the state of punch wear. In this paper, Acoustic Emission (AE) signals from the process utilized to identify the three different punch wear conditions. The recorded acoustic signals after filtering were processed using Hilbert Huang Transform (HHT). Then the instantaneous frequencies and amplitudes were obtained for the signal components. The Intrinsic Mode Functions (IMF) of the AE for the three punch condition were analyzed. With the increase in punch wear the instantaneous amplitude of the signal increases while instantaneous frequency remains unaffected.

Paper No: AIPE#632

A Novel Approach in Developing Aluminum Hybrid Green Metal Matrix Composite Material Using Waste Egg Shells, Cow Dung Ash, Snail Shell Ash and Boron Carbide as Reinforcements

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Abstract. Global development of Aluminum Metal Matrix Composite (AMC) in research, industries and defence with reduced weight, enhanced strength and low cost leads to the establishment of a new hybrid green metal matrix composite using aluminum (Al) alloy as base material with silicon carbide (SiC) and reinforcing it with waste carbonized egg shells (WCE), cow dung ash (CDA), snail shell ash (SSA) and boron carbide (B4C) by altering the different reinforcement weights using stir casting mechanism. Experimental results showed increased hardness, tensile and fatigue strength while decrease in fracture toughness, ductility and corrosion rate which improved by heat treatment. The optimum values obtained were 7.5 wt.% of WCE and SiC+SSA, preheat temperature of WCE and SiC were 3000C and 5000C, respectively. The stability and non-reactivity factors of the reinforcements were stringently considered at optimum temperature. Mono-ethylene glycol (MEG) in aqueous solution was used for experimenting different samples of AMC with varying proportion of SSA. The hardness of the Al alloy incremented to maximum when (7.5 wt.% SiC + 7.5 wt.% SSA) was added and decremented when (10 wt.% SiC + 10 wt.% SSA) was used as reinforcements. The results inferred that using WCE as reinforcement with the Al matrix gave better tribo mechanical properties at a much cheaper rate than uncarbonized egg shells (ES) and SiC+SSA. Overall objective was to introduce a novel hybrid AMC by recycling and reutilizing wastes.

Paper No: AIPE#640

Study the Wear Behaviour of Al5083-7% B4C Composite Fabricated by Stir Cast Technique

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Abstract. Aluminium composite possess significantly better properties as compared to unreinforced aluminium alloy such as high specific strength and higher damping capacity. Metal matrix composite (MMC) is widely used in various industries because they are ductile in nature and light in weight. This paper presents an investigation of the dry sliding wear behaviour of the Al5083 composite produced by stir casting technique with 7%B4C weight percentage and Al5083 .Evaluation of wear rate was conducted by an advanced pin on disc tribotester at different loads (30N, 40N, 50N) and different sliding speed (134 RPM, 200RPM, 267RPM) . Then the investigation from the result of scanning electron microscope (SEM) images of worn surfaces shows that the wear resistance of the Al5083 composite is higher than Al5083. It is found that the damages of the surfaces at low load are less than at high loads and also the damages of surfaces at low sliding distance are less than at high sliding distance. The volume loss increases as the load increases, similarly at the same applied load volume loss increases as the sliding distance increases.

Paper No: AIPE#670

Self-Healing Al 6061 Alloy Reinforced with Low Melting Point Alloys

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Abstract. Self –healing materials can recover/repair damage automatically and autonomously with or without the external intervention. In recent times, many researchers have developed competitive technologies to achieve self-healing properties of materials. This paper presents a methodology to develop self-healing concept in metal matrix composite. Aluminum 6061 has been utilized as the base metal, and a low melting point metal filled into it to develop samples using the injection moulding method. Sand casting has also been used to cast the required sample of Al 6061. To demonstrate self-healing behavior in the developed composite, an artificial crack developed in the sample using a lathe and drill machines. It has been observed that the low melting point alloy gets filled in the crack with heat. This shows the partially self-healing behavior of composite. SEM and Microstructural test has been performed to find out the topological and morphological characteristics of the matrix.

Paper No: AIPE#684

Experimental Investigation of Forming Forces in Single Point Incremental Forming

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Abstract. Single Point Incremental Forming (SPIF) has been confirmed as a quiet economical process for rapid prototyping and batch type production. It exempts complex and expensive tooling as required in conventional sheet metal forming processes. Investigation of forming forces becomes important for selecting the appropriate hardware and optimal process parameters in order to assure perfection and precision of process. Moreover, SPIF applicability can be ensured on the industrial scale when appropriate guidelines are highlighted regarding a relation between input parameters and forming forces induced in the process. This paper investigates the influence of tool diameter, tool shape and wall angle on maximum axial forming forces on aluminum alloy (AA2024-O) sheets. Forming forces has been recorded using a dynamometer and data logger system equipped with Microscada software. Tool shape has been proved a significant factor which affects the forming forces greatly. Combination of higher wall angle and flat end tool with lower side radius results in fracture of components at a lower depth which is an indicator of loss of formability.

Paper No: AIPE#711

An Image-based Approach of Generating Automatic Toolpath for Profile Milling

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Abstract. This paper presents a novel approach of generating machining toolpath for milling operation directly from the given drawing image of the desired 2D profile. An image processing algorithm is implemented using python environment in which coordinates of the 2D profile is extracted to generate toolpath. The graphical user interface is also developed to ease the controlling and changing of machining related parameters. The developed algorithm has been validated by simulating the generated toolpath using 'CNC Simulator Pro software'. The obtained results show that developed algorithm is capable of generating a toolpath for any given 2D profiles.

Paper No: AIPE#715

Study of Machining Performance in EDM through Response Surface Methodology

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Abstract. Electric discharge machining (EDM) is thermal erosion advanced machining process which is capable of machining very hard conductive materials that cannot be machined by any other conventional machining processes. However, process parameters used in EDM has a wide range and for achieving efficient machining optimum selection of these parameter plays an important role. In the present study, discharge current (I), pulse on and pulse off time were taken as process variables in machining AISI 202 stainless steel using a copper alloy tool. This study aims to optimize electrode wear rate, material removal rate as well as surface roughness of workpiece using Response surface methodology (RSM) approach. The results obtained after experimental procedure were analyzed by analysis of variance (ANOVA) technique. Regression equation for the EWR, MRR and Ra were also generated. This study also focuses on surface changes and crystalline changes that occur after EDM process by using different characterization techniques. Atomic force microscopy (AFM), Scanning electron microscopy (SEM) and X-ray diffraction (XRD) techniques has been used for studying the changes on materials after machining process. Based on the experiment it was found that discharge current and pulse on time significantly affect the machining performance. The optimized electrode wear rate and material removal rate obtained was having values 0.000155 mg/min and 0.048175 mg/min, respectively. This study can be helpful for selecting optimum process parameters in machining of 202 stainless steel to achieve efficient machining.

Paper No: AIPE#729

Machining Performance Optimization during Electro-Discharge Machining on Titanium (Grade 4): Application of Satisfaction Function and Distance-Based Approach

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Abstract. Titanium-Grade 4 (3.7065, R50700) is one of the most robust materials and finds its application in aerospace industry specially for making spacecraft, aircrafts, missiles, naval ships, armor plating etc. The main advantage of titanium is that it has a high strength, low density results in less weight. It can withstand very high temperatures also. Machining of titanium was not an easy task, as it is a very hard material and it has poor thermal conductivity, higher pressure load, non-uniform chip thickness etc. So we have chosen Electro Discharge Machine (EDM) for the machining of titanium workpiece. Our aim was by taking peak current(Ip), pulse on time(Ton) and voltage gap(Vg) as input control parameters based on L9 orthogonal array, to find optimum values of response parameters such as material removal rate(MRR), tool wear rate(TWR) and surface roughness(SR). In this research work satisfaction function has been used to obtain the individual satisfaction values of the responses, then these multi-responses have been converted into an equivalent single index. A distance measure has been computed next which basically determines the separation of each experimental setting (alternative) with respect to the ideal expectation (satisfaction). Finally, this distance function has been optimized (minimized) by Taguchi method

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Paper No: AIPE#731

Analysis and Optimization of Surface Integrity Characteristics of EDMed Work Surface Inconel 718 Super Alloy using Grey based Taguchi Method

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Abstract. The aim of this research work is to find the optimum combination of input process parameters such as Peak Current (I_p), Open Voltage(V_g), Pulse-On-Time(T_{on}) & Duty Factor (τ) for machining of Inconel 718 on EDM. The output response parameters studied were Metal Removal Rate (MRR), Electrode Wear Rate (EWR) and Surface Roughness (Ra). L_{16} Orthogonal Array of input parameters was created as the Design of Experiments (DOE) with the help of Minitab software. Grey Relational Analysis (GRA) method is used to get a single domain of multiple output response parameters. After that Taguchi optimization method was applied to find out the optimal parameter setting for higher MRR, lower TWR and lower R_a

Paper No: AIPE#734

Optimization of Electric Discharge Machining Process Parameters for H13 Steel by using Taguchi Method

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Abstract. Electrical Discharge Machining (EDM) is most versatile non-traditional machining process which is used for manufacturing geometrically complex and hard material that are extremely difficult-to-machine by conventional machining processes. As it is non-contact machining process, no or negligible amount of forces are acted on the workpiece so that it can machine any material irrespective of its hardness except non conducting materials. In this investigation, the process parameters such as peak current, pulse on time and gap voltage of EDM were experimentally optimized to obtain the optimum machining characteristics enumerated as material removal rate (MRR) and electrode wear rate (EWR) by using Taguchi technique for machining H13 steel. The obtained results were analyzed by using Analysis of Variance (ANOVA) to identify the significance of each process parameter on the machining characteristics of EDM. The analysis of Taguchi method reveals that pulse on time and peak current have significantly affected the material removal rate and electrode wear rate.

Paper No: AIPE#749

Analysing Attributes of Food Supply Chain Management: A comparative study

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Abstract. With increasing human population and food variety, there is a challenge to provide quality & requisite food to people at the right time at right place. Need to analyses food supply chain management (FSCM) due to its complex nature. The objective of this paper is to review the food supply chain management (FSCM) and identify the significant attributes and further analyses them to differentiate from each other. The identified critical attributes of SCM are relationship & governance, coordination & integration, collaboration, agility, logistics, traceability, packaging, and waste management. We have distinguished the Food sup-ply chain (FSC) from other supply chains, because of the unique characteristics of the food products which pose a serious challenge. Based on the identified at-tributes, we have undertaken a comparative analysis of FSCM with Non-Food supply chain's management (Non-FSCM). The findings suggest towards the importance of traceability and packaging systems in FSC as compared to a Non-FSC.

Paper No: AIPE#752

Friction Stir Welding of Thermoplastic Composites

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Abstract. Polymer matrix composites (PMCS) are replacing traditional metals and unfilled polymers due to their superior properties such as excellent strength/stiffness-to-weight ratio with enhanced toughness and low cost. Friction stir welding (FSW) is a new addition for joining of plastics and it has many advantages when compared with traditional joining process. The aim of this work is to investigate the feasibility of Glass filled Nylon 6 composites by FSW. Glass Filled Nylon 6 Composites were fabricated by an injection molding machine and joined by FSW process with H13 tool steel with cylindrical pin profile. The butt-joint FSW of glass filled Nylon 6 composite were carried out under at tool rotational speed (400, 500 and 600 rpm), tool traverse speed (0.2, 0.3 and 0.4 mm/sec) and tool tilt angle (0°, 1° and 2°) with constant standoff distance 0.2 mm were studied for tensile strength, percentage elongation, joint efficiency and fracture locations. Analysis of Variance (ANOVA) was used to find out the significance of process parameters (tool rotational speed, tool traverse speed and tool tilt angle) with the tensile strength and percentage elongation. The optimized result was achieved at a tool rotational speed of 600 rpm, welding speed of 0.2 mm/s and tilt angle of 2°with defect free welds. It is observed that joining of glass filled Nylon 6 composites are feasible one with proper selection of process parameters and tool rotational speed has a significant effect on weld strength followed by tool traverse speed and tool tilt angle.

Paper No: AIPE#764

Numerical Simulation of Temperature Distribution in Laser Welding of AISI 316

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Abstract.A numerical simulation of temperature distribution of laser welding of 316L austenitic stainless steel have been investigated in the present research. A three dimensional gaussian conical moving heat source has been implemented in the present numerical simulation. ANSYS with certain modifications has been used to account for thermo-mechanical analysis during laser welding. Temperature dependent thermal physical properties of 316L austenitic stainless steel have been considered, which influence the temperature profile in the weldment. The temperature distribution was measured at different process parameters. The effect of laser welding process parameters such as average beam power, welding speed and laser spot diameter on weld bead geometry has been studied. The temperature distribution obtained from the numerical results are in good agreement with the experimental results. The shape of the weld pool profile obtained through numerical simulation are in good agreement with the experimental results.

Paper No: AIPE#776

Solid Waste Management through Plasma Arc Gasification in Delhi:
A step towards Swachh Bharat

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Abstract. Developing countries like India are facing a predicament scenario because of the solid waste and hence itsmanagement is becoming a critical issue. As Urbanization is increasing, enhanced Municipal Solid Waste and its unscientific handling is degrading the urban environment and causing health hazard. Various methods like land filling (major source of methane (CH4) emissions), incineration, composting have been used, but due to too slow operation these processes haven't fully satisfied the growing needs of the waste management. In this paper, we have shown that how CO2 emissions can be prevented from a coal fired thermal power plants in Delhi, if a better method i.e. plasma arc gasification(PAG) processis used for waste management and power generation using the municipal solid waste generated in thecity , which is the need of the hour. The Plasma Gasification process ensures close loop cycle thereby reducing the pollutants from the air. We have done a complete analysis of waste generation and emission production and it is concluded that by this approach we can reduce major pollutants causing global warming due to municipal solid waste.In the present work we have calculated that technology based on CDM (Clean development mechanism) like plasma arc gasification is implemented large amount of carbon of dioxide emission can be prevented in addition to power generation that could suffice the energy need of the city.

Paper No: AIPE#777

Framework the Food Supply Chain Network in the Present Indian Scenario

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Abstract. In India, agriculture sector always takes priority over the other leading areas as the maximum population is dependent on it for their bread and butter. It contributes the major proportion to the Indian economy & most significantly provides nutritional security to the country. Despite of all these facts, the issues like food security, post-harvest losses & socio-economic status of the farmers are the major challenges which create barriers to the development of the country. Recently numerous studies have been found in the concern of food waste and losses along the supply chain. Even so, the 40% of the food is wasted in India according to a report of United Nations Development Programme. In this study, causes of food waste and losses along the supply chain network are identified and weighted based on the survey of previous literature. The aim of this study is to categorize the major causes as a superset and the minor causes as its subset and is represented through fishbone diagram for its clear vision. Secondly the initiatives regarding the reduction in food waste are identified and prioritized using the weighted prioritization matrix approach. This study helps to give an idea about the most significant initiative that government should adopt at large scale in the context of reducing food waste and losses. It is concluded from the results that the linkages between farmers and industries require prior attention over the other initiatives to improve the efficiency and profitability of food supply chain.

Paper No: AIPE#781

Optimization of Critical Process Parameters of Tungsten Carbide in Electro Discharge Drilling

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Abstract. In today's scenario unconventional machining processes have gained its popularity due to its ability to machine highly hard and difficult to machine materials with high accuracy, low tolerance and better surface finish at a faster rate. Electro discharge drilling is a hybrid machining process which integrates conventional drilling process and electro discharge machining. Tungsten Carbide (WC) is an extremely hard composite material having hexagonal structure which is being used in industrial machinery, cutting tools, abrasives, etc. The present study elucidates the drilling of Tungsten Carbide through Electro Discharge machining with influence of spark erosion oil (Seo25) using copper drill bit. In present investigation, L9 Taguchi approach has been adopted to conduct the experimentation and to optimize the critical process parameters Discharge current, Pulse on and off timing and Tool speed for maximum material removal rate with minimum tool wear rate and better surface finish.

Paper No: AIPE#785

A framework for Flexible Job Shop Scheduling Problem using Simulation-based Cuckoo Search Optimization

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Abstract. Cuckoos search optimization (CSO) is an evolutionary, nature-inspired, swam intelligence meta-heuristic algorithm, which is compatible to optimize non-polynomial combinatorial problems. It works based on the living style of Cuckoos. They have obligatory brood parasitism conduct. Basically, the CSO adopted the process of egg emplacing and breeding of cuckoos. CSO algorithm begins with initial population as if genetic algorithm, particle swam optimization and other evolutionary algorithms. Basically, the CSO works based on the cuckoos endeavor to survive amid nests and societies. Due to this struggle, several cuckoos or eggs or chicks demise and the lived cuckoos colonize towards healthier environment. So, the process of "egg laying and breeding" starts again. The survival exertion of cuckoos unites them to form a society which have similar fitness quality of each cuckoo. Hence, this algorithm has been well-known to solve complicated optimization problems. Therefore, in the present work a novel approach, based on CSO algorithm has been framed to handle the flexible job shop scheduling problem. This problem belongs to the typical class of production scheduling having various manufacturing flexibilities as if the real-world manufacturing environment. Simulation is preferred as to compare the mathematical formulation, because it imitates the performance near to a realistic system. Quality function of CSO algorithm has been planned to determine through Promodel© simulation software. The proposed algorithm handles multiple objectives such as makespan, mean flow time and mean tardiness.

Paper No: AIPE#795

An Experimental study to evaluate the Warpage and Cracking issues in Fused Deposition Modeling

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Abstract. Research in 3D printing technology is growing immensely because of the advantage of manufacturing complex shapes in less time as compared to conventional manufacturing processes. However, warpage and cracking are the critical issues in fused deposition modelling technique which results in a reduction in the strength of the component. This paper aims to address the root causes for reducing the warpage and cracking in a 3D printed component. Fused deposition modelling based 3D printer is used in this study to manufacture the samples. The behavior of warpage and cracking in the specimens are studied by altering bed temperature and extrusion width of the filament. The experimental results revealed that printing a component at 1000 C and 0.75 mm extrusion width led to minimum warpage and no crack condition.

Paper No: AIPE#803

A Study on Varying Revolution Pitch for Different Tool Design: Friction Stir Welding of AA 6061-T6

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Abstract. Friction Stir Welding (FSW) is a very promising joining process for joining of light weight material. In this study an attempt has been made to analyze the effect of different tool design for varying revolution pitch. Two different tool pin design namely square and cylindrical threaded is used for the purpose and revolution pitch has been varied in two levels. Spindle torque, down ward vertical force (Z-force) and welding force (X-force) is considered in this study to analyze the effectiveness of tool pin design with revolution pitch. With varying revolution pitch all these entities (Spindle torque, Z-force and X-force) varied significantly whereas square tool exhibits higher amount torque and force .Comparatively improved tensile properties are achieved for square tool at lower revolution pitch. Microstructural analysis of the samples reveals finer grain structure is obtained at higher revolution pitch. With square tool finer grains and dispersions are obtained.

ADVANCES IN INTERDISCIPLINARY ENGINEERING

Paper No: AIE#10

Nox Emission Reduction in Diesel Engine Through Developed Cooled EGR Setup

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Abstract. In the present research work an experimental investigation is performed on single cylinder air cooled direct injection diesel engine by incorporating cooled EGR into the intake manifold for reducing NOx emission. A surge tank is designed, fabricated and utilized for the flow of cooled EGR into the intake manifold as it dampen the fluctuations caused by exhaust gases during engine running. A 20% blend of karanja biodiesel and diesel fuel B20 is utilized for the experimental investigation. The combined effect of varying the percentage of cooled EGR and karanja B20 biodiesel fuel on engine performance and emission characteristics such as brake thermal efficiency, brake specific fuel consumption, cylinder pressure and exhaust emission has been investigated. From the results, it has been concluded that at 100% of engine load the NOx emission reduced substantially from 662 ppm to 503 ppm with 15% of EGR. Also for all operating conditions, a better trade-off between HC, CO and NOx emissions is attained within a limited EGR rate of 5-15 % with little economy penalty.

Paper No: AIE#14

Artificial Neural Networks Methodologies to Optimize Engine Performance Parameters using Matlab

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Abstract. This work is concerned with use of artificial neural network as simulation tool for optimizing the performance of four stroke single cylinder diesel engine operating at various conditions for this performance test on a four stroke diesel engines is conducted and the performance parameters are calculated with standard formulae. The output values obtained from the conventional method are used as input for training artificial neural networks in combination with back propagation algorithm has been performed using MATLAB. The results obtained from the practical networks are compared with the conventional values and the errors are estimated for each parameter. The error deviation obtained against each parameter indicates the net variation of engine output and accordingly the corrective actions may be initiated with the engine for the improvement of performance parameters.

Paper No: AIE#21

Intelligent Analysis of Refrigeration System Using Fuzzy Logic

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Abstract. This paper deals with the working properties of R22 refrigerant to investigate the performance of the refrigeration system and mathematical modelling through Matlab tools such as fuzzy logic and using algorithms based on fuzzy logic to check the efficiency of the vapour compressor refrigeration system and compare it with real world results. It is well known that the evaporator temperature, condenser temperature and compressor pressure affect the coefficient of performance of the vapour compressor refrigeration system. In present paper, COP values are calculated depending upon these temperature and pressure.

Paper No: AIE#30

A Study on Gaming Engines Accessibility

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Abstract. From the past few decades, video games had changed from a leisure time into a perspective of evolution of new changes in humanbeings that is changing the way people think, behave, learn and interact with other people all around the world. In compliment to this, games are also used in the sectors of education and health. Even after all the advancement in the recent gaming engines development many people all around the world are still facing a lot of problem in the accessibility of the games due to their disability. These problems are: (1) Don't receive feedbacks; (2) No identification of in game responses; (3) No way to provide the input from the various input devices used. This paper surveys various gaming engines and their accessibility with the advancement in technology of the gaming engines being used. Majority of games are surveyed for different types of problems faced by people and how the gaming engines have evolved during the last few decades to match the emotions and intensity felt by people playing their respective games with full involvement.

Paper No: AIE#55

Study of Enablers and Attributes for Effective SCM of FMEG: A Review

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Abstract. Globalization of the world economy have forced global supply chains to become more innovative to sustain in this highly competitive global market. With growth in infrastructure project all around the world have given rise to fast moving electric goods industry making it a bustling industrial sector. The purpose of this paper is to synthesize different issues related to FMEG. In all 70 research papers, mainly from referred international journals are reviewed to identify the thrust area of research. On the basis of study, gaps are identified and research agenda is proposed. It is observed from the study that FMEG industries faces a frequent change in consumption pattern due to brief product life-cycle. The organisation involved in FMEG industry face difficulty in determining and forecasting the demand. The point of sale being highly unorganized in India makes it difficult for the industry to match up with customer satisfaction by integration of customer and product development activity. Adding to the adversity is the raw material scarcity in India and delay in transportation from foreign countries. Indian FMEG industries are facing the challenges of intricate supply chains, fast changing market with tighter margins, production better quality products at cheaper price for customer satisfaction. Government taxation and regulation in all energy efficient product along with introduction of e-commerce marketing affects the dynamics of industry.

Paper No: AIE#59

A Review on the Erosive Behavior of Coating Materials for Hydraulic Turbine Blade

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Abstract. Erosive wear in hydraulic turbine is a complex phenomenon, which depends upon different parameters such as silt size, hardness and concentration, velocity of water, and base material properties. The efficiency of the turbine decreases due to erosive wear and finally results in the breakdown of hydro turbines. Many of researchers have conducted experiments to analyze the effect of these parameters on erosive wear, but most of the experiments are performed on small-size samples in different types of test rigs to simulate the flow conditions in the turbine, but in actual flow conditions and the phenomenon of erosive wear are too complex to simulate. Hence, in this work, the status of various coatings of hydraulic turbine was reviewed and comparison of their properties was presented. Based on literature survey various aspects related to erosion in hydro turbines, different causes for the declined performance and efficiency of the hydro turbines and suitable remedial measures suggested by various investigators have been discussed.

Paper No: AIE#78

Reactivity Effects of In-Pin Fuel Motion in Modern Fast Breeder Reactors

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Abstract. The dynamic behaviour of a fast breeder reactor core during an unprotected transient-overpower accident (hereafter UTOPA) is a function of various thermo-mechanical mechanisms. These impact the neutron flux in the core which in turn may affect the reactivity of the reactor. These phenomena are often quantified in the form of reactivity feedbacks. In-pin fuel motion, also known as fuel squirting, is a hydro-dynamic phenomenon which can potentially create a negative reactivity feedback during the accident. The estimation of this negative reactivity feedback is essential for predicting the reactor behaviour and power excursion during UTOPA. In this work, a multi-phase thermal hydraulic model for in-pin fuel motion is dynamically coupled with an in-house reactor dynamics code 'PREDIS' to predict in-pin fuel motion based reactivity feedback and estimate the outcome of UTOPA. Simulations of the reactor core are carried out with parallel processing to determine the melt propagation in different core subassemblies. It is found that in-pin fuel motion positively assists in the mitigation of a UTOPA event during severe accidents.

Paper No: AIE#88

Assessment, Modelling and Optimization during ND: YAG Laser Microgrooving of Titanium Alloy

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Abstract. This study focuses on experimental investigation, predictive modelling and process optimization in Nd-YAG laser microgrooving operation of titanium alloy (Ti6Al4V) by considering diode current, pulse frequency, scan speed, and number of passes as process parameters. The technological response characteristics in laser microgrooving process such as upper width, depth and heat affected zone have been considered to assess the machining performances. Thirty one sets of laser microgrooving trials based on design of experiment (DOEs) are performed along with, analysis of variance (ANOVA), response surface methodology (RSM) and finally, particle swarm optimization (PSO) are subsequently applied for parametric influence study, mathematical modelling and multi-response optimization, respectively. Results indicated that groove width and HAZ decrease with lower magnitude of diode current but opposite trend occurs with scan speed and the groove depth increases with increase of pulse frequency. From the pre-cited parameters, number of passes is found to be the most significant parameter that affects almost all quality characteristics. By solving the optimization problem with PSO, corresponds to optimal setting of process parameters (diode current =24.5 Amp, pulse frequency = 29.36 kHz, scan speed = 40 mm/sec, number of passes = 9) with estimated upper width 0.0596 mm, heat affected zone 0.1303 mm and depth 0.3966 mm.

Paper No: AIE#91

Mechanical Behavior of Stir Casted Al+ZrB2+Al2O3 Metal Matrix Composites

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Abstract: In the recent years many experiments has been devoted to additive technologies and their applications. In the present manufacturing scenario, Aluminum based metal matrix composites are widely used in various industrial divisions especially in automobiles, aircrafts, marine and mineral processing divisions due to its high tensile, impact and hardness values. Although, several compositions are still remaining to research for enhancing the mechanical behavior of Aluminum based hybrid composites. In this direction, present research is based on the development of pure Aluminum (Al-1100) based composites through stir casting process with different mass fractions of Zirconium Diboride and Alumina reinforcement such as 7% Al2O3 - 3% ZrB2, 6% Al2O3 - 9% ZrB2, 5% Al2O3 - 5% ZrB2, 7.5% Al2O3-7.5% ZrB2. Further, obtained performs were converted in to specimens as per ASTM standards and brinell hardness numbers as well as impact strengths were investigated. Increase in the percentage contents of ZrB2 results improved shining nature and reduced ductility of composites at the initial investigation. Also, improved corrosion resistance and mechanical behavior noted from newly developed performs.

Paper No: AIE#95

Impact Strength of Silver Date Palm Leaf Reinforced Polyester Composites

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Abstract. In the present research work, a new composite material has been fabricated using silver date palm fiber as reinforcement in the plain polyester resin. The composites have been fabricated up to a maximum volume fraction of fiber about 0.434. The impact strength of fabricated composites was investigated as a function of fiber content. It has been observed that the impact strength of the composite material increases with an increase in fiber content. It is found that the maximum impact strength of the composite is 290 J for the highest volume fraction 0.434. This results show that at high volume of fiber the silver date palm fibers are capable of preventing the growth of propagating cracks from a surface of the notch, thus reducing the crack by delamination. It has been concluded that using silver date palm fiber as reinforcement in plain polyester resin plays a major role in terms of high impact strength of a new fabricated composite material.

Paper No: AIE#107

Onsite Technical and Economic Performance Evaluation of PWT (Pipeline Welding Technology): A Comparative Analysis with CRC- Evans Welding Technology

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Abstract. During cross-country underground pipeline construction welding is one of the major construction activity. At various parts of the world many pipeline welding machines are in use to produce defect free economic pipeline joints. Every weld machine manufacturer claims its own advantages and other's drawbacks. Two famous welding machine manufacturing companies for pipelines are PWT (Italy) and CRC Evans (USA). Thus the current work at the cross-country gas pipeline construction site from Vijaypur (MP, India) to Dadri (UP, India) (VDPL) is taken up to determine which of the above two mentioned machines are technically better and relatively cheaper while determining weld joint cost and overall pipeline construction cost. Data of two construction sites of VDPL namely Guna and Mathura are collected for weld joint construction and repair. The sites were constructed by ESSAR and EIL for GAIL. The carbon steel pipeline being laid was of 48" nominal size. A detailed cost analysis of the machines is estimated by considering all the related man, machine and material cost, both for mainline weld and weld joint repair. Technical performance of the weld machines is evaluated by comparing various weld parameters for pipeline weld joints. Performance of both of the machines is found to be comparable and almost equal in terms of total cost involved but the repair cost of PWT is less than CRC. Both PWT and CRC are found to produce weld defects with defect of incomplete fusion (IF) more frequently. Suitable remedies are suggested for improvement.

Paper No: AIE#109

Fuzzy Logic Modeling of Explanatory Variables of Catalytic Convertor of an Automobile for Prediction of CO2 Emission

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Abstract. The emission of CO_2gases from catalytic converter demands attention to control for stability of climate system. Inthe present work the explanatory parameters (exhaust gas flow rate, washcoat surface area and exhaust temperature) of catalytic converter of an automobile were modeled to predict the CO_2 emission using fuzzy logic approach. The effect of explanatory parameters on CO_2 emission was also studied and optimum ranges of the parameters were investigated to minimize the CO_2 emission. The result showed the greater dependency of CO_2 emission on engine exhaust gas flow rate followed by the washcoat surface area and exhaust gas temperature. 3D surface plots were also generated to study the interaction effects of the parameters on CO_2 emission. The optimum range of explanatory parameters of catalytic converter for reduced CO_2 emission was obtained as: exhaust gas flow rate: 300 cm^3/min–550 cm3/min, washcoat surface area: 100 m^2/g–130 m^2/g, exhaust temperature: 450^{0}C–750^{0}C.

Paper No: AIE#126

Thermostat Automated Systems Market Variability and Analysis

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Abstract. Thermostat is a device used to regulate the flow of hot/cold air with respect to the specified input under the conditions of a closed area. We have developed an efficient thermostat which has inbuilt temperature module (microcontroller) which collects the raw data complies/compressors it using a processing chip and transfers it via encrypted protocol to the home automation server using Zig-bee wireless sensor network. Tests were conducted with a variation of 25 random people between the age groups of 23-28 and results acquired show that interoperability in manual and automated cooling system except for the fact of power consumption with the rate of variation in cooling and heating processes. In this process we have applied chi-square test and ANOVA test in order to find the variation in multiple products being compared on a relative platform and to serve as a benchmark for the functionality of the device. In order to achieve the results being compared in a non-biased format the variability of each individual subjected to the test is taken into a consideration and is neglected under the rules of these tests which is of 5%, and hence concluded that sample 2 is comparatively better than other products taken for testing from the market.

Paper No: AIE#129

Improved Fourier Polynomial based Phase Modeling for Estimating Instantaneous Frequency from a Noisy FM Signal

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Abstract. Instantaneous frequency (IF) from a frequency modulated (FM) signal has number of applications in engineering disciplines such as telecommunication, analysis of radar signal, music signal, electrocardiogram signal, speed estimation from encoder signal etc. There are many IF estimation techniques and these are divided into various groups namely zero crossing detection technique, time domain technique, frequency domain technique, time frequency domain technique. Among the various IF estimation techniques, Phase modeling by Fourier polynomial can estimate IF from a FM signal by fitting the Fourier polynomial to the zero crossing points. However, in a noisy FM signal, pseudo zero crossing points appear in place of actual zero crossing point. Therefore, a simple Fourier polynomial based phase modeling technique encounters some difficulties while it is applied in a signal of lower signal to noise ratio (SNR). Hence, improved Fourier polynomial based phase modeling technique has been developed for estimating IF from FM signal with low SNR. This improved technique is superior to simple Fourier polynomial based phase modeling technique and estimates better IF.

Paper No: AIE#130

Combustion Event Detection in A Single Cylinder Diesel Engine By Analysis of Sound Signal Recorded By Android Mobile

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Abstract. Combustion event detection is an important issue in internal combustion engine. The combustion is mostly detected by measurement of pressure by a pressure sensor which is mounted in cylinder head. However, the cost of pressure sensor is very high. Therefore, an effort has been made to detect the combustion event in a diesel engine by analysis of sound signal recorded by android mobile. The sound signal carries various frequencies. Therefore, an algorithm based on wavelet packet transform (WPT) has been developed to detect the combustion event in a single cylinder diesel engine.

Paper No: AIE#137

Separation of Nitrogen from Combustion using PSA (Pressure Swing Adsorption) Technique and Incorporating Zeolites

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Abstract. The main problem nowadays for industries to handle is the large amount of emissions that come out of the large chimneys from their boiler plants. Though it is an important part of combustion to emit exhaust, this causes the environment to be polluted and thus also causes harm to not only the life of people present in the industry but also to the water bodies around the industry. The pollution level in New Delhi 2015 was a record breaking 989 ppm; about 600 ppm above the danger limit. Delhi in the year 2016 was named as one of the most polluted city on the planet. These industries not only cause the air to pollute but also the water also which is a needful form of food for many creatures. Keeping all this in mind the main aim of the project that we put forward is the reduction of nitrogen constituent in the air present around us by the use of pressure swing adsorption method. In this method we would adsorb nitrogen present in the air which comes in from a inlet hose and adsorbed in the first chamber with the help of zeolites. For the adsorption of other harmful gasses such as carbon monoxide and SOx, we have also incorporated two types of zeolites (5A and 13X); one which adsorbs the light particles of NOx and other which adsorbs the heavy particles of Sulphur and some other harmful gasses. The main aim of the project is to produce a model that adsorbs nitrogen separating it out from the oxygen so that it can be sent in for better combustion in boilers.

Paper No: AIE#145

Reduction in Exhaust Emission Using Constantan Catalyst in the Diesel Engine

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Abstract. Catalytic convertor plays an important role in reducing harmful emissions in the form of NOx, HC and CO. various technologies have been developed to reduce vehicular emissions, however it comes with the expense of engine performance and cost. In this research harmful emissions from the exhaust gases of diesel engines are reduced without compromising the engine efficiency and cost effectiveness. In this context a new monolith is designed and fabricated with Copper-Nickel alloy (constantan wire) as catalyst enclosed by an aluminum casing. This device is tested on a single cylinder diesel engine at 1500 RPM and it shows 60% NOx, 60% CO and 35% HC conversion efficiency. This research is helpful for partial replacement for the platinum grade material used in the present catalytic converter.

Paper No: AIE#155

CFD Modeling Of Commercial Slurry Flow ThroughHorizontal Pipeline

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Abstract. In this paper slurry flow characteristics of glass beads –water slurry has been studied in a pipe of 0.0549 m diameter using commercial software FLUENT. The study was carried out using Eulerian – Eulerian two-phase model with RNG K- epsilon model turbulence closure. The simulation was carried out for a glass bead particle of size 440 μm having efflux concentration ranging from 10 – 30% by volume with Prandtl fluid (Pr = 5.83) at different Reynolds number. The results of solid concentration contour, velocity contour and pressure drop were predicted at different Reynold numbers to analyses the slurry flow characteristics. The plot between pressure drop vs Reynold number was plotted at different solid concentration. The simulation results of the present study shows the good results with the experimental results of the literature. The present model shows the enhancement of suspension suitability of glass beads particle at a larger distance. Post-validation, parametric studies are carried to study the effect of parameters.

Paper No: AIE#163

Real-Time Vibration Analysis of A Robotic Arm Designed for CT Image Guided Diagnostic Procedures

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Abstract. Robots are used in many fields like medicine, agriculture, industriesetc. A robotic arm is designed so that it can be used in the field of medicine for diagnostic purposes in radiology department. Accuracy, precision and space efficiency play an important role specifically while dealing with biopsies of tumours and cancer tissues. The robotic arm designed here takes the coordinates from the CT image as input and reaches the target point with precision. In this research paper, the main focus is on reducing the vibration of the end needle to increase the accuracy during operation of the robot. LabVIEW has been used for programming to measure the axial vibrations of the links. Accelerometer connected with MyRio controller was used for measuring vibrations caused due to the functioning of actuators. Structure of the robot was optimized by adding a support structure to reduce vibrations. Vibration analysis was done again using same setup. Amplitude of vibrations of Link 4 where the needle will be attached is analyzed using GRAPH software by generating a moving average which acts as a base line. From graphical method it was found that on an average the amplitude of vibration was reduce in the range of 62.5 to 66.67 percent.

Paper No: AIE#167

Development of Low-Cost Wind Power Estimation System in Enggano Island Indonesia

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Abstract. This paper describes an investigation of the wind potential in Enggano Island, Indonesia. A low-cost wind power estimation system was developed. The device is able to log the time series of the measurement data. Non-parametric estimation is used to calculate the power density function of wind power density. The device is portable and has low power consumption. Hence, it can also be used elsewhere in the world where wind power probabilistic characteristics are needed.

Paper No: AIE#172

Performance Investigation of A Nanofluid-Based Parabolic Trough Solar Collector

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Abstract. The present study is performed with the aim to investigate the simple methods of performance enhancement of parabolic trough collector (PTC).Nanofluid proposes exclusive advantages over conventional fluids due to their unique physical properties. In this manuscript, thermal performance of PTC integrated with the storage tank is investigated experimentally using 0.0 wt% and 0.1 wt% nanofluids based on the multi walled carbon nanotube (MWCNT) particles. A nanofluid based on the MWCNT particles using triple de-ionized water as a base fluid is prepared and used as the working fluid in addition to the water for performance investigation. The performance has been evaluated in terms of useful heat gain, collector thermal efficiency, rise in water temperature within the storage tank, charging and overall efficiency of system. Experimental results showed that performance of the collector is improved using nanofluid as a working fluid in comparison to the water and average gain in thermal efficiency is achieved to be about 3% higher with nanofluid. The maximum charging efficiency of system is found to be 62% and 59% with MWCNT nanofluid and water respectively.

Paper No: AIE#215

A Novel System Based on the Principle of Electrochemical Treatment to Reduce Exhaust Emission from Gasoline Operated Engine

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Abstract. The rising population is closely related to the improvement and importance of transportation. More over the rapid increasing Indian economy also entangles manufactures in enhancing the performance of internal combustion engine. The increasing number of vehicles with speedy advancement of technology leading world to have around 2 billion vehicles by 2020.The exhaust emission from these vehicles also contributing to myriad problems. The exhaust contain harmful gases like carbon monoxide (CO), Hydrocarbon (HC), sulfur oxides (SO_x) nitrogen oxides (NO_x) & particulate matters PM2.5 & PM10. Keeping in mind the Environment Act, 1986 of India and The Air (prevention and control of pollution) Act, 1981 of India; This paper is prepared for the betterment of our environment; related to this an idea to introduce an exhaust system in addition to three way catalytic convertor for reducing the gases such as sulfur dioxide(SO_2); carbon dioxide(CO_2); and particulate matter emitted from vehicles comprising a heat absorbing freezer gel pack chamber which would be immediately preceded by the catalytic converter. A chamber containing graphite electrodes in aqueous electrolyte water to absorb sulfur dioxide (SO_2); a chamber for absorbing carbon dioxides (CO_2) in alkali solution; & for trapping particulate emitted in exhaust by catalytic convertor filter layer is being used.

Paper No: AIE#220

The Importance of Methanol Gasoline Blend In Spark Ignition Engine-A Review

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Abstract. The air pollution produced by motor vehicles is getting worse day by day especially in major cities in the world. A very high density of motor vehicle traffic on road and change in lifestyles of the people contributed largely to the increase of pollution. The emission produced by the vehicles must be reduced and controlled to prevent or minimize the air pollution problem. It is also essential to meet the particular country emission standards. The principal polluting agents in gasoline emissions are CO, NO_x, hydrocarbons etc. It was observed by various researchers that the fuel efficiency was improved by using a blend of methanol-gasoline in the gasoline engine. The methanol blend in gasoline was varied, and the performance of the engine regarding maximum output power and braking power was studied in several papers. The chemical and physical properties of the blend were also checked and reported. The present study aims to summarize the performance of methanol-gasoline blend used in spark ignition engine. The review is mainly focused on fuel properties, output power/torque, braking efficiency, emissions etc. It was observed that the CO, NO_x, smoke and particulate matter (PM) concentration in exhaust gas reduced significantly whereas; the CO_2 and unburnt hydrocarbons emissions were increased after using the blended gasoline in the engine.

Paper No: AIE#222

Review on Dental Implant with Special Reference to Tooth Abutment Implant

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Abstract. In the human beings tooth loss is a common problem which may be due to various diseases and trauma. Dental implants are used to provide support for replacement of missing teeth. At the present time research is focused on implant design, materials, and techniques for fabrication of the dental implant. There is still a lot of work involved in the use of better material, implant design, surface modification and functionalization of surfaces to improve the long-term benefits of implant treatment. This paper provides a brief history of dental implant and its classification, success, and failure rate of a dental implant, parameters such as length, diameter, geometry and thread used for the current tooth abutment implant. It also discusses the various complexities associated with the dental implant such as complex design and machining of the screw, its cost, failure due to the motion of implant in the transverse direction, idea to remove complexities, and current technologies.

Paper No: AIE#224

Performance and Emission Analysis of a C.I. Engine Using Ethanol and its Blends with Jojoba Biodiesel and Diesel as a Fuel

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Abstract. An experimental study is conducted to determine the influence of ethanol to the blends of Jojoba biodiesel and diesel on the performance and emissions characteristics of a C.I. engine. The fuel blends used are denoted as D80–JME10–E10 and D60–JME20–E20. In this study, Jojoba Methyl Ester was prepared from the transesterification process. The properties of Jojoba methyl ester were evaluated and compared with the latest biodiesel standards. Also, performance and emissions characteristics were measured on a C.I. engine. The investigation shows that fuel blend D80–JME10–E10 gave an increment in BTE of 2.91% and reduction in BSFC of 3.61% than that of D60– JME20–E20 at full load respectively. Reduction in CO emissions of 9.3% and 12.2% was observed for fuel blends D80–JME10–E10 and D60–JME20–E20 as compared to diesel, at full load. Also, NOx emissions were reduced for the fuel blends D80–JME10–E10 and D60–JME20–E20 of about 40.2% and 28.6% as compared to diesel.

Paper No: AIE#225

Solar Distiller Unit Loaded with Nanofluid - A Short Review

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Abstract.The contemporary issue of potable water shortage can be addressed by providing fresh water from solar distiller unit which solely works on solar energy. This method of solar water desalination is most economical and user friendly. The daily yield of passive solar still varies from 1-3 kg/m^2 and the issue of low potable water production of passive solar still can be overcome by active solar still. The daily yield of active solar still varies from 4-15 kg/m^2. The production of potable water for active solar still can further be improved by using nanofluid. In recent years, the use of nanofluid in solar desalination unit has become popular due to enhanced thermo-physical characteristic of nanofluid as compared to base fluid such as water, oil etc. The use of nanofluid in active solar still reduces the pumping power requirement due to reduced viscosity. The production of potable water for solar still has been found to increase if nanofluid is used due to improved thermal conductivity and absorptivity of nanofluid. In this work, nanofluid loaded solar desalination units ~~has~~ have been reviewed and the future scope has been presented.

Paper No: AIE#236

Computational Investigation of Various Transition Stages in the Drop Formation Process

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Abstract. The aim of this paper to study the various transition stages of drop formation with the help of computational techniques. These regimes are being observed by varying capillary tube dimension and flow velocity. Two different drop formation mechanisms are famed: Either the drops are formed close to the capillary tip—dripping—or they break up from an extended liquid jet—jetting. Dripping faucet regime develops during the transition of the periodic regime to the jetting regime. We use glycerin as disperse phase liquid. We found that for low Weber number, the periodic dripping regimes are obtained whereas, for the high Weber number, jetting regimes are developed. We also study the variation in thread length and size of the breakoff drops and found that the variation of the thread length and the drop's size in periodic dripping is nearly constant while these properties change in dripping faucet regime as well as in jetting regimes.

Paper No: AIE#239

An Arduino Micro-controller Operated Automobile Air Conditioning System

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Abstract. This paper describes the operation of the air-conditioning system of Maruti-Suzuki Wagon-R car which comprises of a condenser, compressor, evaporator, receiver, drier and expansion valve. It works on VCR system with refrigerant R600A+R290. As automation is becoming the pioneer in technology, it is important to step in its vicinity. The air-conditioning model is connected to the computer system through Arduino UNO circuit. Arduino is a single board micro-controller that can sense and control physical parameters. The purpose of establishing this connection is to perform the automatic turning on/off the system and to obtain the temperature readings from the sensors attached to the components of the model. These readings are then transferred to MS Excel software with the help of PLX-DAQ software, where various thermodynamic calculations are performed. From the obtained results, it is found that, the theoretical value of cop is twice that of actual values of COP. Also originate that, the theoretical second law efficiency is about 36% more than its actual value.

Paper No: AIE#249

Experimental Investigation of Bio-Oil based Nanofluid Spray Cooling during AISI 316 SS Turning

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Abstract. Nanofluid Spray Impingement Cooling (NSIC) has huge potential of being used as lubricant and coolant in machining processes due to its excellent lubricating properties and high heat removal capacity. The current study was carried out to improve the machining performance along with heat transfer rate during turning of AISI 316 SS using uncoated carbide inserts under bio-oil based NSIC environment. Different volume concentrations of Karanja oil-based TiO_2 nanofluid were applied during turning operation using the spray setup. Tool and chip temperatures, surface finish and tool flank wear were measured & analyzed. The heat transfer coefficient of the bio-oil was also determined. Linear regression models were developed to predict the machining responses, i.e. tool temperature, chip temperature, average surface roughness and tool flank wear. Taguchi based grey relational analysis was used for optimization of the machining process parameters to obtain multiple performance quality characteristics of the AISI 316 steel during turning in the SIC environment. Results indicate that the application of bio-oil based TiO2 NSIC during turning decreased the peak tool temperatures by 52% as compared to dry turning environment i.e. 220°C to 105°C. There was a noticeable increase in surface finish quality by examination of the average roughness by of about 50.7%.

Paper No: AIE#266

Biodynamic Responses of Human Body in Standing and Seated Position

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Abstract. The paper presents the comparative study of the biodynamic response of human body in standing and seated position. A 3D model of the human body in standing and seated position are generated based on anthropometric data for Indian male subject in SolidWorks. The finite element tool, ANSYS-Mechanical was used to perform modal analysis and to obtain natural frequencies and associated mode shapes for both positions. The principal resonance in both standing and seated position occurred at 5-6 Hz. Further, the responses of the models to seat/floor excitation are derived through harmonic analysis. The frequency response of the human body to low-frequency vibration in both positions was determined in terms of normalized apparent mass and acceleration ratio. Both FE model was able to predict the response of human body that matches with data reported in the published literature. The model will be useful to predict the vibration response of human body under various vibration environments encountered in daily life.

Paper No: AIE#273

Simulation & Modelling Of Solar Trough Collector

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Abstract. Computational fluid dynamics (CFD) simulations are widely used; as these are cost effective in a manner that it saves finance for the preparation of experimental setups, and time involved in experimentation. This paper presents the CFD validation of L2S2 parabolic trough collector, which was determined by Sandia Laboratory USA in 1994. In this paper temperature variation of HTF (heat transfer fluid) with the variation of mass-flow rates are investigated. Further the effects of receiver length and its diameter upon the temperature of HTF and glass cover are also studied. The HTF used here in the CFD model is same as that used in L2S2 parabolic trough collector via Dudley, and this fluid is Syltherm-800. The novelty of this paper lies in the fact that it provides a CFD method to optimize a parabolic collector; that is, for a prescribed value of inlet temperature and solar flux with a particular fluid, what will be the optimized value of its geometrical dimensions and mass flow rate.

Paper No: AIE#278

Accepting Renewable Technologies for Waste Management Promoting Sustainable Living Among Rural Habitats.

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Abstract: This paper elaborates on need of improvement in rural settings and its benefits after use of anaerobic digestion asrenewable energy. The five villages under investigation have a human population of 12,217 and livestock of 8,141, which includes buffalo, goats and hen. Among, livestock total waste discharged by buffalos is around 33 tonnes, goats discharge 3.5 tonnes and hens per day discharge 400 kg of waste. Similarly, human population discharges near to 4 tonnes of excreta daily. This paper proposes a perspective for rural habitats reducing excess burden of sanitation, energy, fertilizers and on health impacts. From estimation human excreta and livestock, both can generate biogas of 2060 m3 daily using renewable techniques. Similarly, accepting improved sanitation may reduce risk of human health after excretion and emission of air pollutant, lowering premature deaths. Practicing anaerobic digestion, accounts to fulfill fertilizer requirement of N, P and K of approximately 74 hectare of land per year. Furthermore, air pollutants such as carbon monoxide (CO), sulphur dioxide (SO2), oxides of nitrogen (NOx), carbon dioxide (CO2), methane (CH4) and particulate matter (PM2.5 & PM10) could reduce to greater extent. Biogas a renewable form can gain additional carbon credits to rural community. Paper tries to present an overall positive viewpoint of such study in rural habitats of developing countries.

Paper No: AIE#286

Optimizing the Performance of Catalytic Convertor using Turbulence Devices in the Exhaust System

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Abstract. Turbulence flow of exhaust gases improves the efficiency of the catalytic converter in the exhaust system of vehicle. In literature, additional devices are used for creating the turbulence. However, they reduce the engine performance by inducing additional backpressure. In this work,various configurations of turbulence generating device are considered for optimizing the performance of the exhaust system of vehicle such as maximum conversion efficiency of the catalytic converter with minimum back pressure at engine exhaust system. In this context, various configuration device for generating turbulence is attached before the catalytic converter for measuring back pressure and analysis the exhaust of four-cylinder 1400-cc diesel engine. The flow of exhaust is visualized using commercial software Fluent for knowing effect of device configuration on the flow pattern. It has been found that the turbulence device with swirl blade configuration is more effective in improving the conversion efficiency of the catalytic converter at low back pressure as compared to other configuration of devices. Therefore, the swirl blade turbulent device is effective and efficient.

Paper No: AIE#297

A Comprehensive Review on LiBr-H2O Based Solar Powered Vapour Absorption Refrigeration System

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Abstract. Solar energy is used for refrigeration cycle in solar powered vapour absorption refrigeration (SVAR) systems. The significance and explanation of eco-friendly SVAR system based on LiBr-H2O are available in the literature. The use of solar power improves the coefficient of performance (COP) of the cycle, and it lies in between 0.27-1.20. The improvement in COP makes it suitable for industrial and commercial purposes. It was claimed that, this system is also worthy for the applications operated ator above 0°C. The use of LiBr as absorbent allows the system to run without expansion valve. Use of water as refrigerant is helpful to keep the operating pressure low in condenser and evaporator. Even if the system works on lower pressure, the COP is not affected. The machine driven parts are installed in pump housings only. Therefore, the complete operation is smooth, and the system is maintenance free. This system might not produce any greenhouse gas and considered as a green technology for future. The load variation does not affect the performance of the system too. The use of LiBr provides the flexibility to replace the volatile liquid from the absorbent refrigerant pair. Also, the liquid exiting the generator does not contain absorbent mixed with refrigerant. Therefore, the analyzer and rectifier are absent which simplifies the design and reduce the production cost. The main limitations of this system are the crystallization and reduction in efficiency at very low temperatures. In this article, the recent developments in the field of LiBr-H2O based SVAR system are reviewed.

Paper No: AIE#300

Multi Objective Process Optimization of Biodiesel Synthesis from Acacia Concinna Seed Oil using TOPSIS and GRA Approach.

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Abstract. The present study reports the potential of Acacia Concinna (wild crop) non edible seed oil as prospective feedstock for biodiesel production. Since A. Concinna seed contains 21.0wt% crude oil, with high acid value of 17.8 mg KOH/g therefore biodiesel synthesis was carried out in two stage esterification process. The obtained biodiesel was characterized for different fatty acid esters and fuel properties strictly according to ASTM/IS standards. Further analysis presents an experimental design methodology integrated with TOPSIS and GRA approach for the selection of most optimal set of process variables for biodiesel production with multi objective optimization of both quantity (biodiesel yield) and fuel properties. At optimum condition, the process variables methanol/oil molar ratio 8:1, catalyst concentration1.0%wt KOH, reaction temperature 600C and reaction time 60.0 min results in a maximum biodiesel yield and calorific value of 98.7%, 37.950MJ/kg with lowest viscosity and FFA of 5.72 mm2/sec, 0.33 respectively. Further analysis provides an overall augmentation of 0.88713 (TOPSIS) and 0.58976 (GRA) in the preferred values of output responses. However, Catalyst concentration was found to be most significant process variable among all. Finally as a conclusion, this comprehensive study indicates the viability of producing A. Concinna biodiesel which makes it a suitable alternative fuel for existing diesel engine technology.

Paper No: AIE#303

Comparative Analysis of Wavelet Encoder and Hybrid Wavelet based Fractal Encoder for Image

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Abstract. This paper presents the comparative review of wavelet encoder and fractal image compression (FIC) based on DWT. Wavelet transforms, and FIC are popularly used as the domain for image compression. Encoder designed in spatial domain cannot exploit the redundancy present in the naturalimage efficiently. In this paper, theimage is encoded using conventional fractal encoding algorithm in both the transforms. Performance of both the encoder compared using compression ratio, encoding time and PSNR. Raw images of size 512 X 512 used to carry the experiment in Matlab2013a. A quick review is arranged in tabular manner in Section 4.

Paper No: AIE#314

Automation of Business Cards

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Abstract. Business card is shared as hardcopy, the data present in business card will be highly useful if it is available in digital format. The task of manually entering the details of all business cards is laborious and time consuming. Document image analysis is used in this paper for automating this process. This will be accomplished by performing OCR and then using the text to extract the Meta data. One more important component of business card is the logo of the organization. The text extraction OCR will be done using the Tesseract API. After conversion of the image to text, the data will be saved in the database. The raw data will be saved in the database, which will later be segregated and stored in the appropriate fields. It is generally ignored in the process of saving text information, in this paper it is extracted and stored in database. For logo detection various techniques like Gabor Filter, Harris edge detection technique, MSER etc., are compared to determine the best technique for acquiring the most accurate logo extraction. Gabor filter gives the best result is used for the extracting logo and storing in database. Java language on NetBeans IDE platform which use the Spring MVC framework is used to implement this work.

Paper No: AIE#316

Fractional Order Sliding Mode Controller forQuadcopter

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Abstract. This paper proposed the concept of fractional order sliding mode control (FOSMC) for chattering reduction and reduced error converging time for Quadcopter. The controller is designed to control over the six degrees of freedom of the Quadcopter and enhances the stability as compared to PI based control. In PI based controllers the high transient overshoots deteriorate the stability of Quadcopter system. The FOSMC improves both transient and steady state behavior of the Quadcopter motion. The FOSMC controller is highly robust controller as it rejects system uncertainties and disturbances drastically. FOSMC controller provides chattering free response as chattering is considered the main drawback in present conversional sliding mode controls. Chattering is low amplitude noise present at high frequencies. For vertical take-off and landing (VTOL), an ERROR sliding surface is considered and then a mathematical analysis is carried out under the sliding mode control law. The input unit step and ramp disturbances are considered to check the robustness of the controller. The Lyapunov based stability criterion is used to check stability of the controller. The controller is tested by simulation in Simulink MATLAB. The FOSMC isn't just gives better execution time with minimum control input, in addition it shows strong, notwithstanding outer load unsettling influence and parameter varieties.

Paper No: AIE#346

An Investigation of the Impact of Injection Profile Shaping on the Performance-Emission Characteristics of an Existing CI Engine: A CFD Approach

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Abstract. Fluid flows an internal combustion engine plays one of the most challenging fluid dynamics problems to model. It is only due to the variation of density along the flow field. So a clear understanding of the flow and combustion process is needed to enhance the engine performance and to minimize emission compromising fuel economy. An attempt is made in this paper to simulate the model of direct injection diesel engine with the hemispherical bowl in the piston using finite volume method. This model is used for understanding the in-cylinder gas motion with details of the combustion process to evaluate the engine performance. Combustion flow simulations were carried out at a different crank angle to analyze the distribution of temperature in the combustion chamber. In addition, swirl ratio, cylinder pressure and kinetic energy at a different crank angle were investigated from the combustion flow simulation. However, injection rate shaping also plays a vital role in combustion and then further affect the subsequent combustion and emission performance. In this study, four different injection rate shapes (base, rectangular, sine, trapezoidal and triangular) with constant injection duration and injected fuel mass is simulated to study the engine performance and emission rate. The emission rate includes NOx, CO, unburnt hydrocarbon, and soot. Finally, simulation results were compared with results that obtained from the experiment. The effect of different rate shapes on emission and engine performance was discussed and concluded.

Paper No: AIE#350

Effect of AR Coating Properties on Diffused Reflectance and Overall Efficiency of mc-Si Silicon Solar Cells

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Abstract. Intensive R&D efforts are going on to increase the efficiency of the solar cells to reduce the cost. The Anti-Reflection Coating (ARC) properties play an important role on the c-Si solar cell performance. It increases the absorption of sunlight in the solar cells which leads to enhancement in current and finally cell efficiency. The ARC is done by depositing a layer of Silicon Nitride (Si3N4) on the top surface of solar cell. The thickness and refractive index of the ARC layer should be such that it minimizes the diffused reflectance of the light. The thickness of the layer should be in the range of 70-90 nm so that it can help in destructive interference for required wavelength of the light. In the present paper we report a study of electrical characteristics of cells with different ARC film thicknesses and refractive index. The optimized cells show energy conversion efficiency up to 18.7%.

Paper No: AIE#360

Comparative Study of Sheet Metal and Carbon Fiber Reinforced Composites Ceiling Fan Blade

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Abstract.A ceiling fan is utilized to circulate the air in the room during summer. The operation of ceiling fan must be quieter and air circulation must be even throughout the room. It should consume less amount of electricity too. The conventional ceiling fan blades are made up of sheet metal. These blades consist substantial weight, and the whole assembly requires more electricity to run smoothly. The use of lighter materials for fan blades instead of sheet metal can provide an ample amount of weight saving. Therefore, the objective of this study is to manufacture the fan blades using Carbon Fiber Reinforced Composites (CFRC) and compare its performance with conventional ceiling fan. The industrial standard was used to fabricate the CFRC fan blades. The sheet metal blades were replaced by newly developed CFRC blades, and the data was recorded and analyzed. The performance of the CFRC blades mounted fans were tested for current requirement, power consumption, fan speed and air delivery at 180 and 230V. The obtained outcomes were compared with the data available for the conventional ceiling fan. It was noticed that the fans mounted with CFRC blades provided higher rotational speed at lower current and consumed less power than the sheet metal blade fans. Nonetheless, the observed air delivery and peak velocity were inferior. This issue might appear due to slight variation in pitch angle or shape/size of the CFRC blades than the original sheet metal fan blades and could be resolved using stringent design and fabrication norms for CFRC fan blades.

Paper No: AIE#362

Kinematics of Sit to Stand Task for Knee Osteoarthritis Patients

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Abstract. With the increase in life expectancy, the population of older people is on the rise worldwide. The health of the elderly has become a socioeconomic problem, burdening the existing health care system. Knee Osteoarthritis (KOA) is a prevalent degenerative knee joint disorder in elderly people posing significant functional disability, degrading the muscular strength and restricting the range of motion of the knee. Understanding the abnormalities in daily life activities of KOA patients are essential for the management of this degenerative joint disorder. In the present study, basic daily life activity sit-to-stand (STS) task has been studied with the objective to understand the kinematics of knee and trunk with spatio-temporal factors in patients diagnosed with KOA. Knee and trunk flexion/extension angles were evaluated for three different feet distances (participant normal sitting feet distance, 20 % greater, and 20% lesser than the normal sitting feet distance). Seat height was kept equivalent to the participants' knee height. Ground and seat reaction forces were also measured to determine the phases of STS task. The kinematics data gathered will help in understanding the KOA patients' tactics for accomplishing the STS task, thus providing an impetus for designing a powered exoskeleton for patients with KOA.

Paper No: AIE#370

A Critical Assessment of J-Integral and CTOD as Fracture Parameters

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Abstract. Elastic-Plastic Fracture Mechanics (EPFM) is often used for the integrity assessment of components made from ductile materials. It offers two fracture criterions viz., the J-integral and Crack Tip Opening Displacement (CTOD) which predicts the onset of unstable crack growth in ductile materials or materials undergoing significant plastic deformation. Hence the measurement of these parameters is vital. After presenting a brief introduction to the J-integral, CTOD and the relationship between these two parameters, the basic technique for measuring the J-integral for mode I problem through numerical simulation for is illustrated. The objective of this work is to critically assess the viability of the aforementioned fracture parameters in the integrity assessment of structures. A number of differences and similarities that exists between these two parameters in terms of quality and measurement methods as given in the standards (such as American Society for Testing and Materials and British Standards Institution) is brought out in this work. In addition, the misconceptions detained about the elastic-plastic fracture parameters is discussed.

Paper No: AIE#371

Financial Performance Evaluation using MADM Approaches in Indian Banks

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Abstract. Performance evaluation is critically important as it helps in identification of weak areas and to plan or re-plan more effective actions for a better performance. Banking sector plays a pivotal role in economic development of any country and in a fast developing economy like India, this sector has a major role to play. Performance appraisal of banks is very significant to boost economic planning. This study aims to utilize multi-criteria decision model to evaluate the performance of banks during the financial year 2017-18. Total fourteen banks were selected for the evaluation process in terms of financial parameters defined by Reserve Bank of India. AHP and TOPSIS methodologies of Multi-Attribute Decision Making have been utilized for the evaluation. In AHP, priority weights of three parameters were determined. These weights act as input for the TOPSIS method and final rank of various banks are obtained.

Paper No: AIE#375

Performance analysis of free air cooling conditioning chamber (FACCC) to develop improved cold chain during transportation of agricultural crops in India

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Abstract. Need to improve the shelf life of agricultural crops, during short transportation using low-cost technology. The objective of this paper is to develop a household technology using the concept of free air cooling conditioning chamber (FACCC). Observed that, after harvesting the fruits and vegetables are directly transported to market without having the recommended ambient condition, thereby losing potency and lower shelf life. Designed an experimental setup on the concept of' free cooling technique, towards the storage and transportation (logistics) of the crops at the prudent temperature. Examined and analysed the result of FACCC model, to observe a drop in the cabin temperature. Results show a productive use in increasing the shelf life of the crop. Optimization helped to improve the cold chain performance of the crop, within a recommended temperature range of FACCC.

Paper No: AIE#381

Nanoparticles Reinforcement Effect on the MMC's Characteristics

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Abstract. Nanoparticles reinforcement in the base material is called MMCs (metal matrix composites) and they possess enriched mechanical properties compared to the base material. Present work models the effect of nanoparticles reinforcement on the MMC's characteristics like mechanical properties and time-temperature history curve during solidification. Materials considered in the present work are SiC (silicon carbide), Al2O3 (aluminum oxide) B4C (boron carbide) and Al606. Thermal conductivity, specific heat and density are analyzed for nanoparticles weight percentage reinforcement varying from 0 to 20 while time-temperature history curve is analyzed by modeling the well-known energy equation using finite different (FD) technique. Individual and collective influence of the reinforcement on the mechanical properties and time-temperature history curve is also analyzed. The results from the present work are validated with the experimental results and found in good agreement. Results reveal that SiC nanoparticle gives the steeper time-temperature history curve compared to the Al2O3 and B4C nanoparticles for same reinforcement. Results also reveal that cumulative reinforcement shows less steep time-temperature history curve compared to the individual reinforcement.

Paper No: AIE#419

Nonlinear Finite Element Analysis of a Gecko Spatula Adhesion on a Rigid Substrate

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Abstract. Geckos utilize the fibrillar structures on their feet for generating strong adhesive forces as well as for rapid locomotion on variety of surfaces. Each toe pad of gecko foot contains arrays of fine hair-like structures called setae, which at their tips, further branch into hundreds of nanoscale spatula-shaped structures. These spatulae adhere to substrates through van der Waals interactions. In the present work, numerical simulation of adhesion mechanism of a gecko spatula on a rigid substrate is carried out using a two dimensional finite element model. To account for the geometrical and material nonlinearities in the interaction between the spatula and substrate, a nonlinear computational contact formulation is employed. For the material modelling of the spatula, a Neo-Hookean hyperelastic model is used under the plane strain assumption. The van der Waals adhesion between the bodies is described using the Lennard-Jones potential. The spatula is gradually peeled off from the substrate by applying rotation and then a vertical pull. The variation in pull-off forces with the angle from which it is peeled off is studied. It has been observed that the pull-off force decreases with increasing peeling angle and has the lowest value at $\theta=90^{o}$ and is equal to 4.82 nN. It has also been found that the pull-off forces increase with increase in adhesion strength (or range of adhesion) or decrease in stiffness (or spatula size).

Paper No: AIE#426

Effect of Oxygen Enrichment on the Performance of A Rotary Furnace: A Harbinger To Ecological Sustenance and Pollution Free Castings

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Abstract. The Iron foundries have been playing a vital role in the industrial development of India. The major problems being faced by iron foundries are restrictions on energy consumption by TERI and emission levels due to which majority of coal fired ferrous foundries in Agra have been closed by an order of the Hon'ble Supreme Court of India. The present state of foundries in Agra reveals that extensive research is necessary to develop an ecofriendly and energy efficient furnace. Therefore, A 200 Kg capacity Rotary Furnace, have been designed and developed in DEI and studied for its technical feasibility, economic efficiency, energy consumption and emission levels. Lot of Experiments were conducted by earlier researcher with heat recovery unit, different fuels and their combination improved the energy requirements and reduced the emission levels but the levels obtained were not as per the required limits of TERI and CPCB. Looking so, a modified heat recovery unit, compact heat exchanger has been designed. Till now researcher has used circular nozzle with central holes but in our case we have used Reillo burners of the type RL/M70-190. Experiments are conducted with new heat exchanger and nozzle using LDO blended with jatropha. The furnace parameters are optimized experimentally and found that using Reillo burners of the type RL/M70-190, modified heat exchanger, rotating furnace at 1RPM using 10% to 20% excess air and 400 degrees air preheat, using 7.5 to 8.5 % oxygen enrichment, emission levels are significantly reduced than CPCB limits and energy consumption is also reduced than permissible TERI limits. The operating cost is reduced by a significant amount and quality of the casting is also found excellent. Hence, use of Rotary Furnace with the above modifications will be a boon for the foundry industry of Agra and India at large.

Paper No: AIE#451

Modelling and Analysis for Barriers in Healthcare Services by ISM and MICMAC Analysis

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Abstract. Modern hospitals offer a panoply of services - diagnostic, curative, preventive and rehabilitative - as per the specific needs of a patient. Since the patient is no more a passive recipient of care, but an enlightened consumer, the provision of high-quality services become indispensable for earning goodwill, improve patient satisfaction and also to garner better online ratings. However, the path to providing quality services is not smooth - there are hurdles galore. The primary purpose of this study is to identify and analyze the barriers to the provision of quality care. To address this purpose, the paper firstly reviews systematically the introduction on healthcare services; secondly, it provides the barriers in achieving the quality level in healthcare services; thirdly it uses an Interpretive Structural Modelling (ISM) and MICMAC analysis for modelling and analysis purpose. Finally, this paper concludes with managerial implications and further research directions for achieving the quality services in the healthcare system.

Paper No: AIE#489

Pothole Detection and Warning System for Indian Roads

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Abstract. This paper is based on an application of mobile sensing: sensing and gathering the surface condition of roads. We will fabricate a system and mention the required algorithms to sense the road anomalies by making a portable sensor that can be equipped in any car or public transport. We will call this system pothole detection system (PDS), it will use the mobility of the particular vehicle on which the system will be fitted, and side by side gather data from the vibrations and the GPS sensors, and further process and filter the data to monitor road surface condition. At first we will deploy the PDS on our own vehicle and test it out in a particular sector of Noida. Using the machine learning approach, we were able to identify and classify the potholes and other road anomalies from the accelerometer data. From the continuous testing and gathering data on a particular stretch of road we were able to put an algorithm that will successfully detect a pothole with 4.3% chance of failure or if the pothole is too small to be detected. It was further conducted a manual inspection of the reported potholes and found that 80% of the road anomalies reported are in need of serious repair.

Paper No: AIE#497

Engine Performance Analysis of a Honda Test Engine with and without using active I-VTEC System

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Abstract. Automobile Manufacturers are always in a process of developing new technologies or alter the previous ones to improve upon the performance of their vehicles. Engine performance is one of the major areas to increase performance of vehicles. To increase the power and torque from the same capacity of engines Honda came up with Intelligence Variable Timing and Lift Electronic Control (i-VTEC) that can be used to increase power and torque as it can control timing valve. i-VTEC can increase engine performance that can make the engine increase power and torque for same input parameters. The aim of this research is to compare performance parameters on active i-VTEC and non-active i-VTEC system on provided Honda test engines. The performance parameters were studied by OBD2 sensor on the test engines. The various readings were studied and curves were plotted to show variation in performance. The test results showed that maximum torque from engine use active i-VTEC is 189.3 Nm at 4900 Rpm and maximum torque from engine non-active i-VTEC is 202.8 Nm at 5350 Rpm. The engine torque using active i-VTEC is 3.67% higher than non-active i-VTEC engine. The maximum power from engine use active i-VTEC system is 180.3Hp at 6910rpm and maximum power from engine non-active i-VTEC system is 163.8Hp at 7020 rpm. The engine power using active i-VTEC is 10.07% higher than non-active i-VTEC engine. I-VTEC organizes timing of valve which can make overlapping on the machine.

Paper No: AIE#499

Self Driving Car using Artificial Intelligence

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Abstract.Self-driving autonomous vehicles are the solution for enhancing the mobility intelligence related to driving. This project presents effective ways for implementation of a self-driving car. Proposed work is based on Artificial Intelligence, Computer Vision & Neural Networks. The proposed technology is implemented on a mini-robot car that was built from scratch which uses Raspberry-pi and a camera as its core. The system built runs a script for complex task handling and sending appropriate commands to the vehicle. Image Processing techniques are also issued in the proposed system to identify various objects and traffic lights on the way. The system learns to autonomously navigate through reinforcement learning. Tensor Board is used to keep track of the working and efficiency of the trained Neural Network. The efficiency of the system is recorded 96% as of now.

Paper No: AIE#513

Mitigation of Risk in CNG station using Fuzzy Integrated Technique

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Abstract. In a CNG refueling station, identification of the risks associated with the complex operating systems and its prioritization is essential. This identification and prioritization will result in proper understanding of the system by reliability analyst and maintenance engineer so as to frame appropriate maintenance planning. A fuzzy rule-based inference model taking into account the failure modes for risk ranking in FMEA to manage risks and make maintenance decisions is applied to a CNG station in this paper. One of the methods used for risk analysis is FMEA (Failure Mode Effect Analysis) where we determine a RPN (Risk Priority Number) by multiplying the feature scores that are obtained from the degree of probability of occurrence (o), severity (s) and detection (d) without taking into consideration the relative importance of the factors. In fuzzy approach, we use a linguistic variable for calculation of RPN. This method is so preferred because it provides us with unbiased judgement. The results obtained from this study show that the ambiguity in the conventional FMEA can be solved with fuzzy approach, and conveniently discover potential failure modes and help in risk and reliability analysis of the system.

Paper No: AIE#518

Role of Additives in Enhancing the Performance Characteristics and Stability of Biodiesel – A Review

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Abstract. Biodiesel is a renewable, non-toxic environment friendly fuel produced by biological processes, derived directly or indirectly from plants, animals, agricultural, domestic or industrial wastes. It has lower carbon emissions and higher cetane number. Although biodiesel is a clean renewable source of energy, due to its chemical instability, there are a few drawbacks related to its performance and storage like poor heat generation capacity, poor efficiency, high viscosity, high cloud point and pour point, high NOx emissions due to excess nitrogen and oxygen, gel formation at low temperatures due to poor cold flow properties etc. To optimize the quality of biodiesel and to increase stability, additives are added to the blend to improve the performance characteristics of biodiesel and to control emissions. The objectives of this review paper are to provide an insight into the need of additives to enhance the performance characteristics like brake thermal efficiency and brake specific fuel consumption of biodiesel, present a literature review of the use of additives on biodiesel, compare the results and investigate the impact of additives on performance parameters and stability. Pyrogallol, diethyl ether, butylhydroxyanisole (BHA), butylhydroxytoluene (BHT) and tert-butylhydroquinone (TBHQ) are the predominant additives under this review. It is clear from research that additives have significant impact on the performance of biodiesel and there is scope for further research into additives to optimize the performance of biodiesel.

Paper No: AIE#521

Investigation of Leakage Sources in Gasoline Muffler Using RCFA, CFDand Experimental Validation

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Abstract. When the exhaust valve is open high-pressure exhaust gases are released one after the other, which combine to form a steady noise. To reduce this unwanted noise a muffler or silencer is used. Thus, quality is a major concern in the production of exhaust components. An inferior exhaust component can lead to the reduction in engine efficiency and increase in undesirable vehicle noise. The major causes of an indecent muffler may arise due to play in the sheet feeder, worn out vertical or horizontal roller set, taper in the horizontal bed or improper sheet stopper settings. This paper substantially aims to diagnose leakage in Gasoline muffler. For this purpose, various statistical tools and leakage test was incorporated. To understand ideal fluid flow inside Muffler, computational fluid dynamics was carried out using Fluent in ANSYS 12.0. Through Root Cause Failure Analysis, it was evident that indecent seaming operation was the prime source of leakage. A fishbone diagram was used to illustrate various causes of defective seam. Which lead to problem detection in Lock Seaming Machine and respective adjustment was carried out. Finally, leakage testing was carried out in Universal Leakage Testing Machine to validate the respective result.

Paper No: AIE#531

Technology Entrepreneurship Capability Development in Indian Automotive Industry

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Abstract. Technology entrepreneurship comprises of technical aspects and ability of entrepreneurship skills and competency. The four interrelated and complementary factors of entrepreneurship technology are: context, firm, technology, and entrepreneur. The merging of these four factors is necessary to create competitive edge in the present scenario. The Indian automobile industries are well equipped with local firms having natural design and development capabilities. These local firms are not only well established global brands but also have good marketing presence in India and other emerging markets. This study focuses primarily on technology entrepreneurship capability development in the Indian automobile industry and reveals the key attributes that shaped the innovative capabilities developments.

Paper No: AIE#532

Green Energy: A building block for Smart City in India

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Abstract. India by 2022 be ranked number one in densely populated Nation by overtaking the China due to population explosion in this century. That yields to acceleration in the urbanization, 30 people per minute moving from village regions to cities takes place for better living standard. Hence, stress imposed over the existing system. For such critical issue Indian Government already initiated sustainable remedy Smart City Mission. Smart city includes following main features: uninterrupted power supply, clean environment, transportation, waste recycling etc. Electrical power is its key domain so this paper focuses on the power challenges and region wise power potential for green energy for the smart city mission of India.

Paper No: AIE#541

An Assessment of Musculoskeletal Disorders (MSD) of Farmers of South Odisha in India during "Seeding, Fertilizing and Weeding of crops"

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Abstract. The musculoskeletal disorders (MSD) of fifty farmers of Odisha during seeding, fertilizing and weeding of crops using a "Standardized Nordic Questionnaire" with a five point rating scale was collected considering two years period i.e. from 2015 to 2017. The MSD level in different body parts like neck, shoulder, upper back, lower back, elbow, wrist/hand, thigh, knees and ankles, were illustrated using "Socio-demographic characteristics" and "Work setting characteristics" of farmers, respectively. Factor analysis was performed for "seeding, fertilizing and weeding characteristics" of farmers to group different parameters under different dominant factors. Further, to illustrate the linkage and linear relationship between important parameters, Pearson correlation coefficient matrix was generated for the seeding, fertilizing and weeding characteristics of farmers.

Paper No: AIE#549

Modification of Two Load Method for Measuring Acoustic Properties with Mean Flow

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Abstract. The Two-Load method is one of the most commonly used methods to obtain the acoustic properties of a test element. It is based on ASTM standard E 26-11, which uses two microphones each on upstream and downstream section of impedance tube to decompose the wave, and then uses transfer matrix to characterize the test element. However, works in the published literature doesn't consider the effect of mean ow. Therefore, in this paper the existing two load method is modified to include the convective effect of mean ow to make applicable in more practical applications. Several experimental measurements have been done in this work on an acoustical element (Simple Expansion Chamber) at different mean ow conditions. Results show that the modified two load method agrees more closely with analytical results than the original ASTM standard. This modified method presented gives better results at conditions closer to the real world applications and can be used to obtain acoustic properties of any acoustical element with mean low.

Paper No: AIE#608

BSA Detection on Polymeric Nanocantilever

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Abstract. MEMS based microcantilevers have become an indispensable technique for mass sensing in the last decade. Presently, the need has come to scale down to nanoscale cantilevers for better and faster sensing. Previously, metallic cantilevers were mostly used for biochemical/analyte detection which are more expensive compared to the polymeric ones. Arrays of sensors can be fabricated easily as SU-8 is highly resistant to chemicals. In addition, SU-8 is also biocompatible, making it the most suitable material for biochemical sensors. Furthermore, due to its low Young's modulus, high sensitivity can be achieved. Polymeric nanocantilevers have been used in this study for detection of BSA (Bovine Serum Albumin) in a short time and low amount of concentration. Deflection was measured and observed through optical beam deflection technique and optical diffraction-based approach using high speed camera.

Paper No: AIE#623

Modeling and Control of Underactuated System using LQR Controller based on GA

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Abstract. Cart-pole system is the benchmark for the study of controls. Literature ensures the availability of various controllers to control an underactuated system at an unstable position. Due to its simplicity, LQR optimal control is mostly used to cart-pole system despite challenges in the selection of LQR parameters. The dynamic model of the cart-pole system is derived using the Euler-Lagrangian method and controllability analysis is considered. According to optimal determination problem of the weighting matrix Q and R in LQR, the genetic algorithm (GA) is adopted and the optimal parameter values are used to stable the system at the unstable equilibrium position. From the results, it has been found that the system is stable, robust than the unoptimized LQR controller. This algorithm can avoid heavy and complicated work, improve the work efficiency, and has strong practicability.

Paper No: AIE#634

Analysis of Higher Alcohol Fuel Blends for IC Engine - A Review

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Abstract. Higher alcohols like Propanol and butanol have some significant advantages over lower alcohols like Methanol and Ethanol. Higher alcohols in engine resting better engine performance due to their lower heating value. The blending of Propanol and butanol is between the ratio of 5 to 20% with petrol and diesel in SI and CI engines also reduces the various emissions which effects the environment and improves spray characteristics. Butanol is thus not only a promising alternative fuel for gasoline, but also a possible replacement for bioethanol as a fuel for internal combustion engines for transportation. There is lack of literature review study on using higher alcohols like propanol and butanol with different blend ratios with diesel and petrol. The main objective of this paper is to analysis the performance of an IC engine using higher alcohols and its blend as a fuel. The study in this review papers to find out effect on engine parameters and various exhaust emission at different blends ratio. This review paper will help in critical areas to address research gaps on higher alcohols as a fuel in I.C engine.

Paper No: AIE#646

Hydrogen Vehicle – Opportunities and Challenges

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Abstract. Hydrogen is likely to be the fuel of the future. It is probably the cleanest possible fuel. It can be made out of water by electrolysis and the product of combustion is also water. On large scale, the hydrogen is produced from natural gas. One of the issues which need consideration is the on-board storage of hydrogen. As hydrogen has low density and the volume required is high, the vessel will be very bulky and heavy. Hydrogen can be used as a fuel in I.C. Engines. Both, the spark ignition and compression ignition engines are suitable for using hydrogen as a fuel. An attempt has been made to study the use of hydrogen in I.C. engines and modifications of the engine to get similar power compared to a gasoline engine. The problem with the combustion of hydrogen is that the reaction is highly explosive. The paper discusses all these aspects in detail. Another route for using hydrogen in an automobile is through fuel cell.

Paper No: AIE#649

A Neural Network Based Comparative Analysis of BR, LM and SCG Algorithms for Detection of Particulate Matter

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Abstract. Air pollution is one of the most common concerns for human health. Air contamination has many pollutants like NO2, PM2.5, PM10 and other harmful gases; which are harmful to the living system on the earth. The quality of air gets affected by these particulate matters. This paper proposes a neural network based prediction model for detection and prediction of air pollution. Performance measurement of Bayesian Regularization (BR) algorithm, Levenberg Marquardt (LM) algorithm and Scaled conjugate gradient (SCG) algorithm has been analyzed.

Paper No: AIE#657

Performance Testing of Biodiesel on CI Engine

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Abstract. Current situation of the world demands an alternative fuel. Bio fuel has several advantages over fossil fuel like they produce less greenhouse gases compared to fossil fuel, allowing for greater fuel security for countries where fossil fuel is not easily available. Waste cooking oil is an alternative. Single step transesterification process is used for converting waste cooking oil into biodiesel. Certain variables are fixed. Variables fixed are molar ratio that is 6:1, catalyst concentration is taken as 1.25% of weight of oil sample, and reaction temperature is taken 60°c. Different blends were prepared using splash blending technique. Different blends of bio diesel prepared such as – B10, B20, B30, B40. Then the experiment conducted on 3.5 KW single cylinder air cooled diesel engine widely used for agriculture sector and for domestic purposes. Performance parameters like brake power, specific fuel consumption and break thermal efficiency with respect to load of the engine. Then the test results were compared with conventional diesel fuel and the experiment result convey that B20 blend biodiesel can act as alternating fuel without any modification in the current setup of engine.

Paper No: AIE#667

Modelling of Photovoltaic Losses from Available Meteorological Data

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Abstract. Solar photovoltaic power plants are most popular these days. The power production is limited by various parameters such as solar radiation, location, type of solar cells, demography, atmospheric conditions, losses, etc. Out of which one of the prominent factor is losses. They occur due to shading and unclean panels. The dust settling depends on the location and atmospheric conditions. Thus, it is difficult to quantify shading percentage and therefore variable cleaning cycle time for panels. Current practice for estimation of power loss is an experimental evaluation for the specific location. The present article discusses the effect of dust settling and shading on the solar PV system, effect of the temperature and wind speed on the power loss. The present study proposes the model for dust settling based on the standard meteorological data available for the location. The probability analysis used to evaluate the time taken to cover 5% solar cell area for various input conditions. This help to decide the cleaning cycle time. Further, the rise in temperature effect is evaluated. It is observed that with 10% probability for PM-2.5 particle settling and 0% probability of PM-10 settling the time taken to cover 5% area is 7.09 hrs. It is observed that for 1 m2 area with 317 Watts input solar radiation the maximum temperature observed is 77oC at noon.

Paper No: AIE#668

Bio Tribological Study of Synovial Fluid in the Orthopedic Implants

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Abstract. The paper focuses on the influence of various constituents of synovial fluid in the lubrication mechanism of artificial implant joints. The performance of synovial fluid varies from individual to individual of different age groups and depends on various parameters such as concentration, composition, surface characteristics, wetting degree, temperature, pressure .The incorporation of minerals such as calcium, proteins and lipids are found fruitful in accelerating the performance of synovial fluid. The condition that favours boundary lubrication in synovial joints is that the contact pressure should be high or sliding speed should be low. The generation of reactive oxygen species (ROS) by neutrophils leads to degradation of hyaluronic acid and this degradation can be prevented by using antioxidants such as manitol, thiourea, and vinpocetine. This review article aims to present an overview of the role of synovial fluid constituents on tribological behavior of orthopedic tribopairs.

Paper No: AIE#673

Design and Implementation of Obfuscating Tool for Software Code Protection

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Abstract. Code obfuscation is a technique to protect the raw source code by making different transformation like changing layout and control flow of the code. This is primarily done by the developers/programmers to obstruct code, understanding and delay malicious code change such that reversing of coding becomes uneconomical by the man at the end (i.e. end user). This technique is adopted in such a fashion that it does not affect the functionalities of the program. The aim of the paper is to make an obfuscator tool which will provide a graphical utility to the programmers to obfuscate their code. This tool can be used for protecting many high level languages like python, JavaScript, java, c and c++. It will use cryptographic algorithm to hide the program logic by encrypting & renaming identifier. This paper also aims at introducing a new cryptographic algorithm which encrypts text to Unicode by applying base64 and devnagari encoding.

Paper No: AIE#681

A Critical Review on Calibration of Robots

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Abstract. This paper presents a state of the art review of the literature on the calibration of robots. The existing studies related to this field are critically analysed and examined to ascertain the trends in the field and to possibly identify one of the best techniques of doing calibration of robots. Since robots are similar to mechanical system which can be influenced by changes caused by wear, manufacturing error, backlash error, assembly of parts.As Calibration plays a very important role in increasing robot positioning accuracy, repeatability and resolution. Hence, this study provides an overview on the techniques for calibration of robots, types of calibration approaches, impact on different kind of accuracy and importance of calibration in operating the robots. So, traditional and non – traditional approaches are confined here to calibrate serial and parallel robots. The cost effective way of choosing technique is determined to provide absolute accuracy of the robot. Calibration of Parallel Robots is quite complicated as compared to serial robots. So, there is always need to determine the best method of calibration which is less costly and reasonable.

Paper No: AIE#685

Castor Biofuel a Renewable Energy Source in India- Status & Overview

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Abstract. Renewable energy sources help to alleviate greenhouse gas emission and increasing rate of global warming. Energy production from renewable energy sources is increasing drastically. Due to enhancement of pollution in world, there is need to give attention on development of projects, policy framing, and operations in renewable energy technologies and their implementations. Bio fuel are seen as pollution free energy source and optimum use of these resources helps to reduce the environmental impact and to develop suitability in accordance with the current social needs of the society. Biofuel technologies provide a huge opportunity to reduce greenhouse gas emissions and reduce global warming by replacing conventional energy. Bio fuel will play significant role to create the pollution free environment throughout the globe, it is a reagent that can be used to generate energy. Biodiesel from castor oil generates huge energy with zero emission of pollution, by proper implementation it can reduce the pollution like PM2.5, PM10 etc. which are main sources of air pollution. The paper focuses on castor oil as biofuel and its scope as fuel in Indian Scenario.

Paper No: AIE#686

Renewable Energy-based Hybrid System

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Abstract.There is energy scarcity in rural India. Energy generation and transmission is very challenging area in today's scenario Energy supply in isolated rural areas by using small scale power generation is found to be inexpensive and convenient alternative of grid utility. Under the present work a systematic method has been established to develop a stand-alone renewable energy-based hybrid system for rural areas. In the stand-alone mode, energy supply to rural households can be achieved by single renewable energy technology or combinations of different available energy sources. Further, various criterions and parameters are used for designing a hybrid energy system are discussed in detail. Different criterion include economic, technical, power reliability, social aspects, environmental aspects related to hybrid system. Various challenges that deviate the development of the system are also discussed in the paper.

Paper No: AIE#688

Performance and Combustion Analysis of a PPCCI Engine with Diesel as a Premixed Fuel to Reduce Soot Emission

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Abstract. In this research work, premixed fuel (diesel) with varying premixed ratios (0.25, 0.50 and 0.75) in manifold along with traditional in-cylinder injected diesel was used. The results were compared with conventional in-cylinder injected CIDI engine. It was observed that unburnt hydrocarbon (UBHC) and carbon monoxide (CO) increase when compared to CIDI mode. Brake thermal efficiency was found to be slightly decreased. Soot emission decreases as the premixed ratio increases. Significant reduction in oxides of nitrogen was achieved with the partially premixed Charge Compression Ignition (PPCCI) mode for all the premixed ratios used. Diesel premix ratio of 0.25 was observed to be optimum as the brake thermal efficiency reduction was only marginal compared to diesel mode and the soot emission was lower than that of diesel.

Paper No: AIE#689

Theoretical Study of Solar Air Heater using MATLAB

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Abstract. This article present mathematical study of solar air heaters roughened with three different turbulent promoters. In this study arc-shaped ribs, broken arc-shaped ribs and arc shape ribs present in 'S' shape form are considered as turbulent promoters. In this research work numerical modeling of solar air heater is conducted in MATLAB. Thermal efficiency amplification factor η_{ex} / η_{ths}, effective efficiency amplification factor η_{eff} / η_{effs} and exergetic efficiency amplification factor η_{ex} / η_{exs} are considered as performance factors. The temperature rise parameter ($\triangle$T/I) is the only independent parameter considered in this study and its varied from .0001 to .0151. Solar air heater with arc-shaped ribs roughness has higher values of thermal efficiency amplification factor η_{th} / η_{ths} effective efficiency amplification factor η_{eff} / η_{effs} and exergetic efficiency amplification factor η_{ex} / η_{exs} than other two turbulent promoters. Arc-shaped ribs creates high heat transfer rate with least exergetic losses of all the three turbulent promoters

Paper No: AIE#690

Path Planning of Multiple Unmanned Aerial Vehicles based on RRT algorithm

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Abstract. An optimal Path planning method for multiple Autonomous UAVs have been basedon the modification of Rapidly exploring Random Tree (RRT) algorithm by using the rapidly exploring random tree (RRT). The proposed method improves the path of RRT algorithm in 2D configuration space. The improved RRT algorithm is used to form the same path for each iteration and generate the minimum distance between the nodes. Moreover, path reconstruction strategy has been put further to handle the problem of multiple UAVs. The effectiveness of proposed method has been demonstrated through simulation using MATLAB.

Paper No: AIE#694

Coal Mine Rescue Robot Simulation using V-rep and Python

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Abstract Coal mines are very dangerous working places for human beings let it be the workers or rescue team personnel. It is very urgent but risky also to enter the mine tunnels in case of disaster for the rescue team personnel due to lack of information about the environmental conditions of the disaster sites and a large number of rescue operations have resulted in numerous fatalities in coal mines. Rescue robots can be designed to navigate the rescue personnel around the disaster site and at the same time monitor/update the environmental data on real time basis to command center. This paper introduces a coal mine surveillance robot which is designed in such a way that it can navigate around the mine/sites and keep updating the information to the command center/rescue team using the sensors deployed on the robot on real time basis. Smoke detection along with gas detection is done with high precision and can activate alarm after breaching safe/preset level.

Paper No: AIE#695

Characterisation and Zeta Potential Measurements of CuO - Water Nanofluids

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Abstract. Nanofluids have emerged as potential new generation heat transfer fluids comprising of solid nanoparticles having typical sizes (1- 100 nm) suspended in base fluids. The heat transfer characteristics of nanofluids are significantly influenced by thermophysical properties. In this work, CuO – H2O nanofluids were synthesized characterized and zeta potential was measured using Malvern zeta sizer. Different weight concentrations (0.02, 0.05, 0.1, 0.2 and 0.5 wt %) of nanofluids were synthesized and their effect of concentration on thermal conductivity was examined. CTAB (Cetyl trimethyl ammonium bromide) was used as surfactant. Characterization of the nanopowder samples were performed using XRD and HRTEM. Results showed that CuO – H2O nanofluids showed noticeable increment in the thermal conductivity when compared with water. Zeta potential results also showed that nanofluids are quite stable except the 0.5 wt %.

Paper No: AIE#696

Analytical Model to Predict the Dislocation at Different Interfaces in Thin Film Multilayer: Application to Led Multi Quantum Well (MQW)

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Abstract. The analytical model to predict the density of misfit dislocations at different interfaces in a piezoelectric multilayer with two thin film layers deposited on a thick substrate has been formulated considering the two-stage relaxation with the aim to generalize further for the multilayer system in future. Different lattice parameters of the film layers and the substrate give rise to high misfit strain. Misfit dislocation formation at the interface releases excessive misfit strain. The internal energy of the piezoelectric thin film at the critical thickness and after relaxation through 'n' number of misfit dislocations together with the energy of the misfit edge dislocation have been utilized to develop the formulation. This formulation has been used to estimate dislocation density at the interface of the gallium nitride film layer with various cases of misfit strains. It has rightly predicted higher dislocation density for higher misfit strain cases as well as for greater film thickness. It will be used to predict the dislocation densities at the gallium nitride – indium gallium nitride interface and the sapphire – gallium nitride interface of the LED device in future. The theoretical model developed in this work can be beneficial in estimating the optoelectronic performance of the LED devices correctly in the presence of defects. The model can also be helpful in developing strategies to reduce the dislocation density by accurately predicting them for the given misfit strain in the film.

Paper No: AIE#699

Surface Modified Carbon Fibre Reinforced PA6 and its Blend Based Composites

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Abstract. Polyamide 6 (PA6) matrix based composite system are widely used in automotive sector. PA6 can be directly used as matrix material, but for avoiding the moisture intake by PA6, Polypropylene (PP) has been used as a secondary polymer and PP grafted with maleic anhydride (PP-g-MA) has been used as compatibilizer. The use of carbon fibre as reinforcement increases the strength and stiffness of the composite. Laminate composites have been studied for automotive and wind turbine blade application. But, commercially injection molding is used for making automobile components. In that case, short carbon fibre (SCF) can be used as reinforcement. In this study, the effect of surface treatment of SCF on mechanical properties of PA6 and its blend based composites has been studied. Two types of modification have been compared viz., sizing and coupling agent. To investigate the effect of sizing and coupling agent, commercially available SCF were desized by thermal etching and then modified with suitable amount of Epoxy and Silane as sizing & coupling agent respectively and its effect on PA6 & modified PA6 matrix was studied. Mechanical properties and thermal properties of the composites were studied using tensile testing and DSC analysis. It was found that epoxy based sizing is suitable for PA6 and silane based coupling agent is suitable for blend based PA6 matrix.

Paper No: AIE#704

Study of Bubble Dynamics and Free Liquid Surface Mixing in a Rectangular Container having Ullage Area with Double Gas Inlets

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Abstract.In this work, the Volume of Fluid (VOF) [1] method is used to study bubble dynamics and collapse of bubbles on free surface in a rectangular domain with double gas inlets. The simulation is done by using open source CFD software OpenFOAM-3.0.1. The conservation equations for mass and momentum, which incorporates the influence of surface tension and gravity, are solved by using PIMPLE algorithm. The physical model for the simulation process is a 2D rectangular domain with a width of 50 mm and height of 100 mm. In order to study the collapsing of the bubble on the surface and free liquid surface mixing, an ullage area of 15% was considered within the domain. The numerical computation was performed with multiphase solver interFoam. Modeling of the geometry, meshing and setting the boundary conditions were done, using the OpenFOAM software. The simulation results were compared with available literature results and found that the bubble formation and dynamics are in good agreement. The behaviors of gas bubbles emanating from two adjacent orifices at different gas velocities are studied. Mixing behavior in the bulk liquid due to bubble formation under different inlet gas velocities was also numerically investigated. The impact of surface tension and density of bulk liquid on collapsing of the bubble on the free liquid surface is investigated numerically.

Paper No: AIE#714

Performance Enhancement of Induction Motor Using PID Controller with PID tuner

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Abstract. The real time industrial systems are continuously subjected to time varying load and other disturbances. The induction motors are extensively used in numerous applications due to rugged construction and need for low maintenance. However, the induction motors are categorized by intricate, extremely non-linear and time-varying dynamics and henceforth maintain their speed is a stimulating problematic in the engineering. This paper is grounded on the performance improvement of induction motor subjected to disturbances by means of proportional integral derivative (PID) controller. The PID controller parameters are optimized using PID tuner software available in Matlab. The simulation results show the efficacy of the proposed scheme.

Paper No: AIE#717

IoT (Internet of Things) based Emergency Push Button System

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Abstract. This paper aims at aiding the security industry by enhancing the security of people anywhere and everywhere by creating and analyzing a system that makes use of an emergency push button service. The proposed system involves notifying the family members or close relatives of the user around the globe as soon as the button is pressed (for instance, during emergency situations). The system involves making use of the microcontroller ESP8266 chip, which is a WiFi compatible chip, and the IFTTT (If This Then That) web service. The underlying concept used for making the system is Internet of Things, which allows machine-to-machine communication. The system makes use of email and SMS notifications that are sent to the recipients who are well known to the user along with the user's current location. The proposed system also finds a wide variety of uses in the mechanical industry. It can be used in factories to pinpoint the exact location of dysfunctional machine parts, or in automobile vehicles during emergency situations. This system is extremely cost effective, handy to carry, sturdy, and reliable, and if implemented on a larger scale, can be a huge boon to the security industry in the near future.

Paper No: AIE#730

Investigative Analysis of Thumba Bio Diesel Blends in A Single Cylinder Four Stroke IDI CI Engine At Varying Loads

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Abstract. The present study investigates the performance(BThE) and emission(UHC,NOx) of Thumba bio diesel at varying load percentages with respect to diesel.The experiment was conducted in an IDI CI engine at 34%,67% and 100% load conditions at constant 1500 rpm.Total three blends were used for the experiment.The first blend was 100% diesel(PD),second blend was Thumba bio diesel 10% diesel 90%(Blend 1) and the third blend was Thumba bio diesel 20% and diesel 80%(Blend 2).The experimental result of the both bio diesel blends were compared with diesel.From the experimental result it was found that both the bio diesel blends showed comparable results of BThE,But UHC was lower for the blends whereas NOx was higher for both the blends compared to diesel.From the experimental work it was also found that the Blend 1 (Bio diesel containing Thumba bio diesel 10% and Diesel 90%) had better results than Blend 2.Also Blend 1 showed comparable results to diesel.

Paper No: AIE#739

Breast Cancer Detection using Image Processing Techniques

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Abstract. Image processing is a widely used methodology in various medical sectors. Image processing involves performing some operations on images to extract some useful information. Image analysis are very helpful in early detection of various cancers in which time factor is very crucial. In this paper, we address the problem of Breast cancer. The number of cases of breast cancer have increased worldwide. In this paper, the methodology has been proposed for early detection of breast cancer. The early detection of breast cancer can save life and make treatment less complex. In the following paper mammogram and MRI, the two important modalities have been used for segmenting of tumor portion.

Paper No: AIE#742

Reduction of Noise of Cloud Medical Images Using Image Enhancement Technique

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Abstract. There are so many images available on cloud which are used by researchers and doctors to find new cures to diseases and better diagnosis of patients and there are many more other reasons, but because of the blurriness these photos do not serve the purpose as intended. This paper compares two wavelets results and suggests the better one by which we can improve these images by reducing the noise in them and make them much more useful. In this paper white Gaussian noise removal technique has been suggested using Stationary Wavelet Transform from raw ECG signals method. The simulation results presented in this paper proves that proposed method is the best fit for these images and will provide the user with a good quality image with improved visibility.

Paper No: AIE#756

Segmentation of Skin Lesion Images Using Fudge Factor Based Techniques
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Abstract. Automatic edge detection is an important and non-invasive step in skin lesion identification. In this paper the segmentation of skin lesion image is proposed by using edge detection operator with an adjusted threshold value. The clinical skin lesion image is first preprocessed via hair removal, contrast enhancement and filtering techniques. After this the skin lesion is segmented using a standard edge detection technique. The fudge factor is introduced and tuned in this detection to adjust the threshold value. For comparative study Sobel, Prewitt and Canny edge detection techniques are applied in the skin lesion image. The segmented outputs are compared using entropy and dice similarity index values of the segmented image.

Paper No: AIE#763

Nanomaterial in Lubricants – A Real Approach
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Abstract. Nanolubricants are the advanced form of lubricants which can improve efficiency in term of both energy saving & enhancing the machinery life-cycle. Nowadays, these advanced lubricants are the hot topic of great interest due to their high potential application in wide areas. Previous studies have clear that even a minute quantity of nanoparticle, when dispersed in base fluid shows great potential to improves physical, chemical transport, thermal and radiative properties of base engine oil. This paper focuses on preparation of nanofluid and their properties along with the application of wide range of nano-particles in lubricants. Buckminsterfullerene, detonation nanodiamonds, ultradispersed boric acid and polytetrafluoroethylene (PTFE) are the considered various range of nano-material. Modern advancement had been done on engineering lubricants by grafting the nanoparticle in traditional lubricants or high viscous fluid like Grease. It is strongly suggested that nanomaterials have the latent for enhancing convinced lubricant property. Still, there is a time-consuming step need to be follow in-order to formulate or developed nanolubricant to enhance the properties of traditional oil.

Paper No: AIE#778

Emission Control System Using Lambda Sensors and Application in Soil Respiration

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Abstract. Most vehicles since 1986 Lambda sensors have no less than one oxygen sensor and now vehicles frequently have at least two oxygen sensors. An oxygen sensors work has changed minimal throughout the most recent 30 years from when they were first utilized as a part of European fuel infused autos yet their significance in motor activity has expanded altogether oxygen sensors are currently basic in present day vehicles engine management and emission control systems. An oxygen sensor screens the measure of oxygen in fumes gas. The measure of oxygen in the fumes gas is a decent pointer of motor ignition proficiency and is likewise the best place to screen the air to fuel proportion, things being what they are there is a specific proportion of air and fuel that is immaculate and that proportion is 14.7: 1, otherwise called the stoichiometric proportion (diverse energizes have distinctive impeccable proportions, the proportion relies upon the measure of hydrogen and carbon found in a given measure of fuel). An excessive amount of oxygen in debilitate gases shows a lean blend. A lean blend tends to create more nitrogen oxide contaminations NOx, and now and again it can cause poor execution including fizzle and even motor harm with the motor running excessively hot. Too little oxygen shows a rich blend, which squanders fuel and decreases economy, and the unburned fuel brings about overabundance outflows. Either condition can abbreviate the life of the costly exhaust system. The oxygen sensor is situated in the ventilation system downpipes before the exhaust system or between the ventilation systems and the exhaust systems.

Paper No: AIE#780

Renewable Energy Sources and Development in their Use

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Abstract. Green Power termed to be the most emerging and useful power which any nation have. With the continuous depletion in the level of fossil fuels and with exponential increase in demand of energy, only way out to meet this demand is Non-Conventional energy resources which termed as green power. This also helps maintaining the greenhouse gases or rather reduces their level and heading towards a sustainable energy. This paper presents review on various Renewable energy systems, their optimizing and modeling technique, their interfacing mechanism, In depth knowledge of Green energy etc with different mathematical models, Algorithms like HOMER,GA,PSO etc.

Paper No: AIE#791

Performance Analysis of PV System Integrated with Boost Converter for Low Power Applications

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Abstract. This paper presents standalone PV system integrated with boost converter which can be used for low power applications. The performance of PV is affected due to changing temperature and irradiation. In this paper the Current- Voltage (I-V) and Power – Voltage (P-V) characteristics have been obtained for a PV module for varying temperature and solar irradiation. In the present study, the boost converter design connected to a PV module has been simulated in Matlab/ Simulink and its performance and the analysis of results have been discussed in this paper. It is known that there are many regions of India which are still without electricity so focus has been done on standalone systems so that basic lighting can be provided in such areas. The present research will be helpful to implement PV systems for standalone low power applications like street lighting, small domestic load, charging of mobile phones etc.

Paper No: AIE#800

Modal Analysis of 132KV Double Circuit Electric Power Transmission Tower Made Up With Composite Material Thermoplastic Long Carbon Fiber Nylon66

Chiranjit Bhowmik1, Prasun Chakraborti2, Shankar Swarup Das1 and Ram Singh1
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Abstract. In recent days, tendency of composite materials uses in tower structural member material is increasing tremendously over conventional zinc galvanized steel materials because of their special advantages. Using the composite materials over conventional materials in the field of large structure construction like tower in mass scale, it is important to study the dynamic behavior of these structures made up with composite materials in detail. Modal analysis of tower structure made up with composite materials has been reported few or all most nil in the literature. This study has taken up the challenge for the modal analysis of the present design approach of 132kV double circuit tower made up with composite material like Thermoplastic Long Carbon Fiber Nylon--66. The results found for first six modes of vibration using subspace iteration method. The results are compared with the results obtained by typical conventional method, still followed by the industry for erection of such high tower made up with conventional material like zinc galvanized steel.

Paper No: AIE#801

Decision Making for Selection of Most Suitable Materials for Biomedical Applications

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Abstract. The selection of an optimal material needed for the design and development of various biomedical implants is very complex and challenging task today. Such implants are necessary for orthopedic applications as substitutes of various human joints like hip, knee, ankle, shoulder etc. Hence a simple mathematical and logical tool is needed to enable the decision makers to take correct decisions in selecting most suitable materials in spite of many selection attributes. This paper presents the applications of some novel Multi-Attribute Decision Making (MADM) techniques like AHP (Analytical Hierarchy Process), WPM (Weighted Product Method), and TOPSIS (Techniques of Order Preference by Similarity to Ideal Solution) etc. to accelerate the selection process of biomaterials for hip joint implants and enhance selection confidence and objectivity. The material selection is mainly based on their preferential ranking in all the methods. It is found that the Metal on Metal (MoM) pair is the best candidate for the hip joint implants among all other pairs such as Ceramic on Ceramic (CoC), Ceramic on Polyethylene (CoP), Metal on Polyethylene (MoP) because it is at the top rank in all the methods.

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Cultural Events

Amity University aims to encourage students to hone their interests in extra-curricular and creative fields through their participation in the creative arts outside of the academic curriculum and scope. The purpose of the various cultural activities is to provide social, cultural and recreational activities for the college community apart from inculcating in them a sense of aesthetics that they can pursue lifelong. The cultural events provide inspiration and opportunity to students to work on individual and group activities. The students develop and organize own activities and can demonstrate and develop their leadership and decision-making skills.

The cultural programme during FLAME-2018 will showcase a variety of activities exhibiting the talent of our students, starting with lighting the divine lamp by the dignitaries which will be followed by Saraswati Vandana and Kathak prayer dance presented by the student of Mechanical Engineering department Ms. Uhinee who is a trained Kathak dancer. Kathak is the Hindi name for one of the eight major forms of Indian classical dance. The origin of Kathak is traditionally attributed to the traveling bards of ancient northern India known as Kathakars or storytellers.

Hindustani classical music is the traditional music of northern areas of India. Besides vocal music, which is of primary importance, its main instruments are the sitar and sarod. Classical music can be divided into melody and rhythm. The music will be played by DASP which is the official music society of ASET.

Bhangra which is one of the popular folk-dance form in Punjab region of India will be performed by the Khalsa Warriors who are the official Bhangra Society of Amity University. It was followed by mesmerizing cultural and folk dances like Bharatanatyam depicting culture of India in form of group dance, solo song and key board playing.

Programme Schedule				4th October-2018 (Thursday)		
09:30-10:15 AM	Plenary Talk by Prof. Anand Asundi, NTU, Singapore- (F2- Auditorium)					
10:15-11:00 AM	Invited Talk:Dr.Rituparna Datta, KAIS&T, South Korea (F1-Seminar Hall)			Invited Talk: Prof. (Dr.) Atul Sharma, IIT- Bombay (F3-Seminar Hall)		
11:00-11:15 AM	High-Tea					
11:15-12:00 PM	Invited Talk:Prof. (Dr.) S P Harsha, IIT Roorkee (F1-Seminar Hall)			Invited Talk: Prof (Dr.) Sandeep Patil- Director (E Spin NanoTech) (F3-Seminar Hall)		
Session 3 (12:00-1:30 PM)	Venue 1 (F2- Auditorium)	Venue 2 (F1- MDP Hall)	Venue 3 (F1- Seminar Hall)	Venue 4 (F3-Seminar Hall)	Venue 5 (F3-MDP Hall)	Venue 6 (F3-LG-02)
	3-A Design Engg. Paper Id	3-B-1Thermal Engg. Paper Id	3-C Industrial Engg. Paper Id	3-D- 1 Inter-Disciplinary Paper Id	3D-2 Inter-Disciplinary Paper Id	3 B-2 Thermal Paper Id
	319	208	476	224	303	270
	325	213	481	225	316	292
	329	218	486	236	346	315
	330	231	493	239	350	331
	344	237	498	249	360	354
	364	248	500	266	362	361
	374	253	97	273	370	379
	382	254	515	286	371	397
	393	267	517	297	375	410
	408	269	102	300	381	412
1:30-2:00 PM	LUNCH					
Session 4 (2:00-3:30 PM)	Venue 1 (F2- Auditorium)	Venue 2 (F1- MDP Hall)	Venue 3 (F1- Seminar Hall)	Venue 4 (F3-Seminar Hall)	Venue 5 (F3-MDP Hall)	Venue 6 (F3-LG-02)
	4-A-1 Design Engg. Paper Id	4-B Thermal Engg. Paper Id	4-C Industrial Engg. Paper Id	4-D-1 Inter Disciplinary Paper Id	4D-2 Inter Disciplinary Paper Id	4 A-2 Design Engg. Paper Id
	417	430	524	419	634	553
	444	454	530	426	646	567
	458	480	538	780	657	599
	471	509	555	489	667	606
	474	525	560	499	668	609
	488	534	562	513	685	639
	491	577	566	518	686	672
	516	578	568	541	688	687
	540	595	569	608	689	726

Department of Mechanical Engineering, Amity School of Engineering and Technology, Amity University Uttar Pradesh organized 1st International Conference on Future Learning Aspects of Mechanical Engineering (FLAME-2018). This is an international peer-reviewed academic conference. The conference seeks to provide a forum for a broad blend of high-quality academic papers in order to promote rapid communication and exchange between researchers, scientists, and engineers in the field of mechanical engineering. The mission of FLAME-2018 is to detect novel trends in Thermal, Fluids, Energy and Process Engineering, Mechatronics, Control and Robotics, Material Science and Engineering, Solid Mechanics and Structural Engineering, Dynamics and control, Engineering Design, Manufacturing and Industrial Engineering, Automobile Engineering etc.

The first edition of this book includes the abstracts of all presentations in 1st International Conference on Future Learning Aspect of Mechanical Engineering. This book thoroughly includes all the latest development in Field of Mechanical Engineering.

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