



**DEPARTMENT OF MECHANICAL
ENGINEERING
IIT DELHI**

ME NEWS

Vol. 3*, Issue 1, January 2017



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***Replacing the RS News and MES Newsletter with a combined new version**

Message From The Head of The Department

Happy New Year 2017 to the readers of this newsletter!



Prof. S.K.Saha

It gave me an immense pleasure when the GPS (Group of Post-graduate Students) members informed me last month that they are joining hands with the MES (Mechanical Engineering Society) students to bring out the Newsletter. It is always important to have synergy. The present newsletter is a perfect example of the efforts by the UG and PG students. I am pretty much sure about the benefits both groups will draw while working and interacting together, and learn from each other. Let more and more M. Tech/M.S. and Ph. D students take active roles in the MES activities by becoming its member. I have been told by the Faculty Coordinator of MES, Dr. Supreet Singh Bahga, that he is adding more value addition propositions for the members of MES. Hence, my appeal to all students is to join MES by paying a nominal fee.

As per as our weekly seminars by the Ph. D students go, I again thank the volunteers and all the student presenters for making it successful events. There has been a proposition about the two departments (Mechanical and Applied Mechanics) conducting weekly seminars together so that the students from both the departments benefit from the presentations of each other, as in many occasions their areas of research overlap. If this happens, it will be another example of synergy for making one plus one equal to more than two. Let us keep up the motto or working together for better research and outcomes!

About GPS (Group of Post Graduate Students)

GPS, a group of PhD Research Scholars of Mechanical Engineering IIT Delhi, would like to congratulate everybody a very Happy New Year 2017. This year we wish to take GPS to next level of success. GPS provides a platform to the PhD scholars joining the department by conducting regular PhD seminars, arranging guest lectures, publishing Newsletters every academic semester and wonderful get-togethers. This kind of a group helps in active interaction within the PhD students and learn from each other during their busy schedule. The GPS group comprises of two faculty and three Ph. D scholars.

Prof. S.K. Saha- H.O.D

Dr. Naresh V. Datla- Faculty Co-ordinator

Abhinav-PhD Student Coordinator

Arun-Seminar Coordinator

Jaswant-Student Representative

Amit -Arrangement Team Incharge

Anand (B.Tech), Jaskaran, Anvesh- Editorial Team members

GPS-Webpage: - <http://web.iitd.ernet.in/~mez148337/gps.html>

Welcoming New Faculties

The Department including GPS and MES groups would like to welcome two faculties in our mechanical family. We would like to heartily congratulate them and wish them all the best for their future research and career.

Dr. Mayank Kumar completed his M.S and PhD from Massachusetts Institute of Technology. Previously he completed his bachelors in Mechanical engineering from IIT Kanpur. His research interests are Multiphysics Simulations of Energy Conversion Systems, Turbulent Multiphase Reacting Flows, Coal Gasification & Clean Coal Technology.

Dr. Debabrata Dasgupta M. Tech, PhD and post-doc from IIT Kharagpur in the field of Microfluidics. Previously he completed his B.E from Jadavpur University. His research interests are Microfluidics and microscale transport processes, Computational Fluid Dynamics, multiphase transport, transport in multi-scale systems.



Ph.D Articles

A comparative study of various constraint enforcement techniques for rotor stator rub



Recent investigations on rotor-stator rub is based on contact mechanics approach, which presents a more realistic modelling approach. Among various methods of constraint enforcement, Lagrange method is commonly used. Alternate techniques include augmented Lagrange and penalty approach. The Lagrange method ensures perfect constraint enforcement while penalty method allows some hypothetical penetration depending upon the choice of penalty parameter. Dynamics of the rotor with unbalance is simulated and the rub phenomenon is studied over a wide range of speed ratio by each of the three methods. The study concludes that the penalty method is relatively easier to implement and can be used as an alternate option for constraint enforcement in rotor stator interaction with carefully chosen parameters.

Md Asjad Mokhtar

Understanding Courts Delays using Operations Management Principles



There are more than 3 crore cases pending in Indian courts and these cases take several years to get resolved. The system is on the verge of collapsing and there has been no systematic quantitative analysis for the reasons behind these court delays. I modeled the case procedure in courts as an operations process. This gave me an insight into the bottlenecks and constraints within the system. It also allows me to simulate how much the constraints can be eased and its impact. Such quantitative policy recommendations have not been produced before.

Shobhit Mathur

Re-configurability and Economic Sustainability in Global Supply Chains



A framework that holistically considers all the major enablers of reconfigurability and their interrelationships for organizations that are planning for structural changes in their supply chains to enhance economic sustainability will be discussed. Total Interpretive Structural Modeling (TISM) methodology has been adapted to research reconfigurability enablers. MICMAC analysis is done to understand the driving and dependence power ranks of the reconfigurability enablers. The enablers were ranked according to their levels using TISM. Sustainability, New Product Development and Customer Satisfaction stands at the highest level of priority. With the MICMAC analysis, the clusters of variables were identified for both enablers and dimensions of reconfigurability. Reconfigurability dimensions such as Customization, Diagnosability, Integrability, Convertibility and Modularity are addressed.

Pallab Biswas

Development of a numerical model to determine radiative properties of representative open cell foam structure.

Development of a numerical model to determine radiative properties of representative open cell foam structure. This model is able to identify two important radiative properties i.e., extinction coefficient and scattering albedo of an idealized foam structure. Moreover, dependence of radiative properties on solid reflectivity and pore density will be presented.

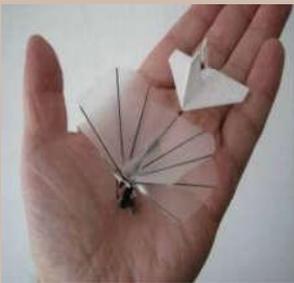
Vipul Patel

Study of fire propagation in Shamiana

Fire is an uncontrollable behavior of combustion. It is a phenomena of fluid dynamics which is driven by turbulence, radiation and chemical kinetics. Fires in shamiana/ tent have made many casualties and property loss. Therefore, it becomes very important to understand the behavior of such fire. In this study, experiments have been design on single panel of shamiana with both cellulosic and non-cellulosic materials. The knowledge of single panel experiment leads to the multi panel experiments. Multi panel experiments includes transfer of fire from one panel to another and temperatures on and around the fabric panel.

Hitesh Verma

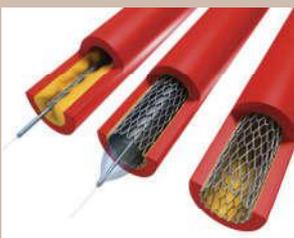
Role of passive flexibility on forward propulsion of a plunging membrane



Scientists and biologists have been affianced in a deeper examination of insect flight to develop an improved understanding of the role of flexibility on aerodynamic performance. Here, we mimic a flapping wing through a fluid-structure interaction framework based upon a lumped torsional flexibility model. The developed fluid and structural solvers together determine the aerodynamic forces and wing deformation, respectively. An analytical solution to the simplified single-spring structural dynamics equation is established to substantiate simulations. It is revealed that the dynamics of structural deformation is governed by the balance between inertia, stiffness and aerodynamics. We demonstrate that an induced phase difference between plunging and passive pitching is responsible for a higher thrust coefficient and inferences thereby drawn will act as starting points for the design and analysis of realistic and bio-inspired MAVs.

Nipun Arora

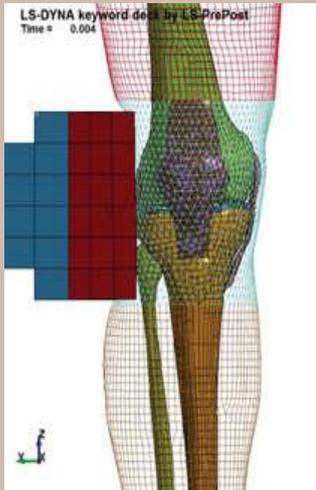
Biomedical Application of Bioresorbable Polymeric Tubes and its Manufacturing.



Bioresorbable polymers have opened a new field of research in the area of biomedical devices. These polymers perform their function once placed inside the body and when their intended function is over, they disappear from that body part so there is no need for removal of the implant from the body. This advantage associated with these polymer make them the current choice of the researcher's worldwide. The tubes of the bioresorbable polymers have found their place in the treatment of plagued artery (stenting), nerve conduits, vascular grafts, tracheal grafts etc. to mention a few. For few of the medical device application the polymer tube is required in pure form and some require the polymer tube be foamed and porous. The manufacturing method of both type of the tubes is different and will be discussed in my presentation.

Pooja Bhatti

Master's Articles



Finite Element Model of Human Knee Subjected to Impact From Automobile

FE model of human knee subjected to automobile impact

WHO, 2015 report estimates that out of 1.25 millions road traffic deaths occurring every year, 22% account for pedestrian. Fatalities of these pedestrian accidents can be minimized by design modification of vehicles to reduce their aggressiveness, which require experimentation. With advancement in computational technology, Finite Element (FE) models like THUMS, GHBMS of Human body have provided effective means for these experimentations. The Present work aims at modification of FE model of human knee joint in order to improve its bio-fidelity. Multibody and FE simulation of real world accident are carried out using suitably modified FE models to predict actual accident conditions and injuries suffered by a pedestrian. Those simulated injuries results are then compared with real world injuries to check for bio-fidelity of the model.

Mitesh Lalwala

Adaptive Mesh Refinement to Study Viscous Flow Problem

The aim of this project is to develop a finite volume based Navier Stokes flow solver to study viscous flow problems. The solver will be employing an Adaptive Mesh Refinement (AMR) module. The adaptive mesh will refine the mesh in the flow domain where the solution gradient is high and coarsen the mesh where the gradient is low. This adaptive mesh based flow solver will reduce the computational cost associated with fine mesh to capture the solution features. This in house code of Adaptive Mesh Flow Solver will be later used to study boiling flow problems where computational cost is high associated with mesh size to capture the flow physics effectively.

Giridhar Jambare

Specific Energy model for sustainable machining of Nimonic 90 work material

Machining of Nimonic 90 at higher cutting speeds is expected to take care of some of the machining difficulties. This project presents a semi-analytical model that predicts specific shearing energy of the work material in primary as well as secondary shear zone. It considers the formation of adiabatic shear bands which occur at higher cutting speeds during machining, along with the evaluation of the effect of strain, strain rate, and dependence of temperature on the shear flow stress using Johnson-Cook equation. The stick slip phenomenon in the friction zone of the rake face has also been discussed and incorporated in the model.

Om Prakash

Development of wear durable tribological coating

Bearings usually fail due to high friction and wear in between the ball and the race as their surfaces are subjected to high contact stresses. Polymers have high strength and stability to shear stresses. In this work thermosets polymer and their nano-composites have been used to develop thin coatings which protect as well lubricate the surfaces of the bearings. It has been found that these thin coatings provide low coefficient of friction and are highly wear durable.

Neha Singh



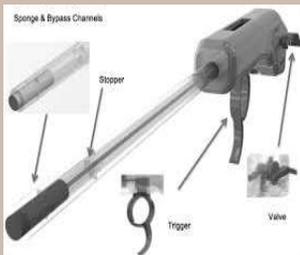
B.Tech Articles

Study Of Feedback Loss In Laproscopic Device



With the advancement in medical science the Minimal invasive surgery has become an integral part of modern treatment. In MIS four to five small incision are made and doctors operate through these holes using laparoscopic tools. Due to MIS, the wound sizes decreased to about 10 -15 mm from 100 mm and so the recovery time of the patient is reduced.

In a hand-held laparoscopic surgery, the doctor uses Laparoscopes and insert it through the incision in the skin and operates on the tissue. The ability of a doctor to perform complex surgery is significantly enhanced due to the precision and accuracy of laparoscopic tools.



One of the limiting issues in the laparoscopic surgery is the lack of tactile sense to the surgeon. Insufficient force propagated to the jaw tip (point of action) may cause tissue slippage while excessive force may lead to tissue rupture. In current tools, the surgeon has to rely solely on visual feedback as the tactile feel of 'slipping' is not transmitted back to the surgeon.

we look at manufacturing tolerances that resulting in the fade-off in tactile sensation of handling the tissue to the surgeon. Specifically the role of friction and joint clearances resulting in the loss of feedback and establishing the force bandwidth of the tactile sensation available to the surgeon while manipulating the tissue.

In our study so far it is found that for normal laparoscopes with manufacturing tolerance of 25 microns the force bandwidth of the feedback of device is much below the value needed for the reasonable tactile sense transfer. For the mathematical modelling of tissue for surgical simulations, frequency range of 300 – 1000 Hz is used and the force bandwidth of the surgical tool should cross the range in order to allow the surgeon get a sense of touch. For crossing the bandwidth value of 1000 Hz the precision of the manufacturing needed to be high in order to reduce the clearance in the joint due to tolerance.

MD. Zafar

Raiesh Kumar

Paper Presentation At SII2016 Conference, Japan



I had an opportunity to visit Japan for presenting a conference paper at SII 2016 on "Touchless Human Mobile Robot Interaction using a Projectable Interactive Surface" in Human Robot interaction Session. This visit is part of the collaborative research with Prof. S.K.Saha and Prof. Takafumi Matsumaru of Waseda University. Being an undergraduate student it feels fortunate enough to travel to Japan for presenting my research work and learn a lot from other research work conducted in other reputed universities. The visit to Japan and learning from Japanese people to take care of minutes details of anything has been worthy

Pratyusha Sharma

Foreign Exchange Experience -FRANCE



Foreign exchange semester feels like a rebirth in your social life . You have to learn new language meet new peoples , understand their culture and adapt yourself according to environment which sometimes difficult and sometime great fun. Surely the parties,will be the best part when you make new friends and everything starts

to fall in right place.

In academic perspective I was introduced to a different education system . Unlike IIT Delhi some courses just finished in 2-3 weeks , some starts in between semester, exams and quizzes almost each week so "Funda" of typical IIT student to study just night before minor and major is not going to work here .Also , the students here are exposed to different domains like business , marketing , Innovation, pharmacy along with their specialised line of engineering and also have option to learn one more new language apart from French and English which is great fun (for me it was Japanese).All Courses are in French so I faced difficulty at start but the professors here are very encouraging and supportive you will see them cracking jokes in lectures and tutorials which add fun to the learning atmosphere .

For research students they are well paid and provided with everything they need and there are lot of Indian students in aerospace masters and research program . Last but not the least it provides a great opportunity to travel and make your mark in lot of European countries which was just dream before this .

Rahul Dev Boora
Exchange student
Ecole Des Mines Albi, France

Rc Aircraft , Workshop For Beginners By Aeromodelling Club IIT-Delhi

To give a head start and boost to the aeromodelling community in the campus aeromodelling club had organised a 2 Day (on Nov. 27 and 28) workshop for the beginners to give them hand on experience regarding the basics of RC-AIRCRAFT. The workshop gets a huge response from the student community, especially from the first year students from UG, and this year the input from PG Students was Increased, which is a very positive symbol. There are some more workshops coming in the coming semester so to stay updated on the news regarding these and any other events from aeromodelling club please keep checking the facebook page of club.

Joy of Sharing

This event has been conducted in order to help scholars, masters and undergraduates to learn from each other by presenting on different past or recent experiences they have mastered during their research work.

Date	Research Scholar	Topic
3rd Oct 2016-	Hitesh Verma	Exposure to citation manager software Mendeley.

4th Oct 2016 Arun Unnikrishnan Understanding CREO
6th Oct 2016 Abhinava Chatterjee Purchase Procedure at IIT DELHI
7th Oct 2016 Riby Abraham and A. A. Hayat Latex for Thesis

About MES and its Activities

Mechanical Engineering Society incorporates enthusiastic members from undergraduate, masters and research scholars group for conducting various activities related to mechanical engineering. The activities include conducting presentations, invited talks from academia and industry, workshops for higher studies abroad, competitive events, software training like ANSYS, Pro-E and conducting fresher's welcome party.

Few Publications

Khanam, S., Tandon, N. and Dutt, J. K. (2016) Multi-Event Excitation Force Model for Inner Race Defect in a Rolling Element Bearing, *Journal of Tribology*, 138, 011106

Gaur, P., Chawla, A., S. Mukherjee, Verma, K., Lalvani, S., Malhotra, R. and Mayer, C. (2016) Characterization of Human Diaphragm at High Strain Rate Loading, *Journal of Mechanical Behavior of Biomedical Materials*, 60, pp. 603-616

Bhanot, M., Rao, P. V. and Deshmukh, S. G. (2016) An Integrated Sustainability Assessment Framework: A Case of Turning Process', *Clean technologies and Environmental Policy Journal*, 18, pp. 1475-1513

Goswami, A., Aravindan, S. and Rao, P. V. (2016) Fabrication of Substrate Supported Bimetallic Nanoparticles and their Optical Characterization through Reflection Spectra, *Superlattices and Microstructures*, 91, pp. 252-258

Arora, N., Gupta, A. and Shyy, W. (2016) A Shifting Discontinuous-grid-block Lattice Boltzmann Method for Moving Boundary Simulations, *Computer and Fluids*, 125, pp. 59-70

Guest Lectures

Prof. C.P.Arora (Retired Prof. IIT Delhi) -- "History of RAC ; Legacy, Diligence and Spirituality" on 31-08-2016

Mr. Vijay Kumar (Maruti Udyog, AAI India) -- Competitions of Developing Industries to cope up with market changes on 20-10-2016

Prof. H.R. Srirangarajan -- "Simplest SDOF to most complicated Vibrations (CHAOS)" 02-11-2016

Dr. Suresh Bhalla--"Piezoelectric Materials: Applications in Structural Health Monitoring, Energy Harvesting and Biomechanics" on 07-12-2016

Presentations Schedule and Webpages

Weekly Research Seminar

Day- Every Wednesday

Time-3:45pm Onwards

Venue- ME Seminar Room(II-422)

Find Schedule At--> <http://web.iitd.ac.in/~mez148337/gps.html>