Association for Machines and Mechanisms
News Bulletin

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Our Objectives and Activities

The main objective of AMM is to contribute to mechanical design at all levels starting from academic research to industrial initiatives, thereby enhancing the quality and reliability of indigenous machines. With this in view, AMM organises the National Conference on Machines and Mechanisms, NaCoMM, and the workshops on Industrial Problems on Machines and Mechanisms, IPRoMM regularly.

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Message from the Editor-in-Chief

ENGINEERING EDUCATION
To unshackle the system from the barriers of language and technology is the need of the hour.

A few days ago, I happened to watch a TV programme where persons in two unrelated fields were interviewed together: Project Director of the Lunar Mission, Mayilsamy Annadurai, and the comedy actor, Vivek. The latter recalled a funny piece of his lyric, bringing out the lighter side of the launch vehicles taking a dive into the sea. After several successful launches in recent times by the Indian space agency, the GSLV D3 with the indigenously-built cryogenic engine failed miserably, despite the launch having been scheduled reportedly at an auspicious time.

On a recent occasion, I visited an industry that makes earth moving equipment and defence components. A large number of heavy components were conspicuous by the way they lay scattered in an orderly fashion on either side of the walkway, and I hesitantly asked the official who guided us whether they were perhaps scrap. "These are our inventory!" he said. "The good ones on the left side are imported ones from Italy. Apparently, they have a good coating technology. The rusted items on the other side are Indian." The company's plans had apparently changed, leaving the inventory in disuse for the past three years.

Ahead of the World Classical Tamil Conference in Coimbatore coinciding with the commencement of the forthcoming academic year, Anna University, one of the oldest Engineering Institutes in the country, is working on its plans to introduce engineering education in Tamil medium. Language is a hurdle for most students from the rural populace. A few of the conventional engineering courses may, of course, be taught with a little of effort in the local language. Whether that will have any positive bearing on the quality of the education imparted and the competence of the graduates produced remains to be seen.

Albeit the controversies related to the actual yield of the thermonuclear device tested in 1998 and the Indo-US Nuclear Deal of 2009 having left the common man and the engineering community perplexed alike, India's nuclear programmes for defence and energy security may continue uninterrupted with the current generation of scientists. ISRO will eventually be able to find and rectify the cause of the recent failure. Several Indian industries that face problems typical of this will manage to solve their problems of the present through external collaborations or indigenous attempts, actual or labeled. Nevertheless, no clear policy on higher education with proactive efforts leading to technology independence is in sight.

As Indians, we have always revelled myopically in our prehistoric contributions, eventual successes, and symbolism. After 25 years of privatisation of higher education, the performance of the apex educational bodies itself is being questioned with suspicion and the need for their continued existence is being debated. Unless the higher education, especially the undergraduate engineering system, is thoroughly overhauled and teaching methodologies changed to ensure active involvement of the 'parentally- guided' generation of students, all the efforts and the vision of Homi Baba, Vikram Sarabhai, Jawaharlal Nehru, and other leading lights of technology and education in modern India, would go down the drains of history.

Let us be optimistic that academicians and policy makers will preempt this eventuality.

P. Vivekananda Shanmuganathan
Editor-in-Chief

From the Secretary's Desk: *New Initiatives of AMM*

Last December we had the biggest event on the AMM calendar, the NaCoMM, which was held successfully at the NIT Durgapur. The gamut of AMM activities is on a steady rise and the credit goes to the continued support of the members.

Students' Design Contest and Best Paper Awards: New features were added to NaCoMM on this occasion, such as the introduction of the Students' Mechanism Design Contest and the two AMM Best Paper Awards, for the student as well as the open category. The AMM Best Student Paper award went to *Mr. Rashmi Ranjan Das of IIT Kharagpur*, while the AMM Best Paper award went to Mr. Sudarshan Hegde of IISc Bangalore. A detailed report on the design contest is included in this bulletin.

IPROMM 2010 and NaCoMM 2011: As per the tradition, the AMM members met informally on the sidelines of NaCoMM-09, and deliberated on the possible venues of the forthcoming NaCoMM and IPRoMM. It has been decided that IPRoMM 2010 would be held in MNIT, Jaipur, with Dr. Himanshu Chaudhary of the Department of Mechanical Engineering (ZVP North, AMM) in charge of the organisation. NaCoMM 2011 would be held in IIT Madras, with Dr. Sandipan Bandyopadhyay of the Department of Engineering Design (Secretary, AMM) as the main organiser. Looking forward to see you all in IPRoMM 2010!

Students' Activities Coordinator: The members also felt the need to introduce a new post: a Coordinator for the Student Activities of AMM, and Dr. Nirmal Baran Hui of NITD was elected for the same. We welcome Dr. Hui in this new position!

New Contents AMM Website: It is a pleasure to share with you that the AMM website has now grown substantially in content. The proceedings of some of the previous NaCoMMs (2003, 2007, 2009) are now available online. There are known problems in accessing some of the files in some browsers as many of the files are old and do not conform fully to the compatibility standards. We are working with the organisers of these events to update the files, and we hope that in near future all the content should be available to you. We also request the organisers of all other AMM events to send us their proceedings in CD/DVD, so that we can upload them on the AMM site.

Contact Details Update Form: While on one hand AMM is growing at a steady pace, we do have a problem which is growing faster with time! We are losing contact with our members because they are not updating their contact details with us while moving from their registered locations. Further, we do not have the email addresses of most of the members who have joined before August 2008. To correct this, we have placed a membership data update form in the AMM website under the link "Membership information" on the left panel. Please complete the form and email/post the same to enable us to be in touch with you! For your convenience, we have included a hardcopy of the same with this bulletin.

Sandipan Bandyopadhyay
Secretary, AMM

NaCoMM 2010 Students' Design Contest

A national level students' design contest was held in December 2009 for the first time as part of the National Conference on Machines and Mechanisms (NaCoMM 2009). The competition that was open to undergraduate students was held in three stages with focus on the *Use of Pneumatics in place of Conventional Systems*. As a prelude to the contest where everyone was a winner, Mr Bhavser presented a technical talk on behalf of the event sponsor and manufacturer of pneumatic systems and kits, Janatics India Pvt. Ltd. Prof S.K. Saha, on his part, gave an inspiring talk aimed to motivate young students to take part in robotics and design competitions.

Among the entries received, thirteen entries were shortlisted for the second stage in which they were required to submit a detailed technical write-up. On the basis of the write-up, four teams were invited for presentation at NaCoMM 2009. The event sponsor M/s Janatics India Pvt. Ltd. took care of the travel and accommodation of the teams in the final while the prize money was sponsored by the Organizing Committee of NaCoMM 2010 and AMM. The organizers had made arrangements for pneumatic power supply by bringing in a portable air compressor.

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Thickness and Compression Tester for Fabrics[#]

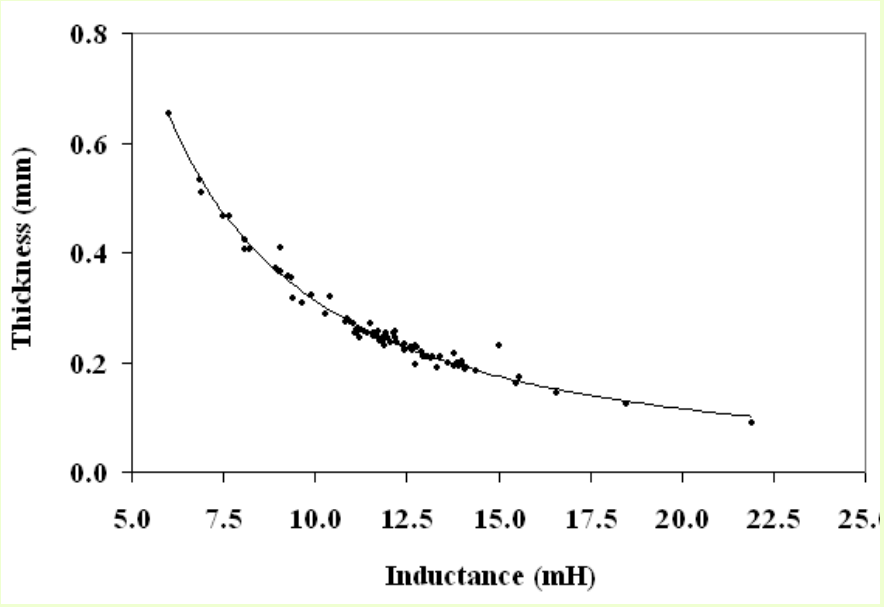
Industrial measurement systems which often have to work in real time need to be robust and reasonably accurate. Textile machineries available today are equipped with a number of sensors and mechanisms to ensure uninterrupted production and acceptable quality levels. They need to be cost effective too. Researchers in IIT Delhi have developed a fabric thickness and compression tester that works on the principle of composite magnetic circuit. Fabric thickness is generally evaluated by measuring the distance between two parallel plates separated by a test sample. Various gadgets are commercially available to measure the fabric thickness. The underlying principle of all these equipments is based on monitoring of the distance between the two parallel plates.

The instrument has been developed using UI 100 core of Ferrite, which is a composite of Fe_2O_3 with oxides of one or more bivalent metals such as Manganese (Mn), Zinc (Zn), Nickel (Ni), and Magnesium (Mg). This type of core has relative permeability of 2000 or higher. The instrument consists of two coils, each having 1500 turns, wound over the two limbs of the U-section. The coil is made of copper wire of 33 SWG, which can carry electric current up to 150 mA without overheating. This current capacity is said to be sufficient even when using the instrument for online measurement.

Fabric thickness tester developed by IIT Delhi

The fabric samples were placed between the U and I section (see figure). As the magnetic permeability of fabric is much less than that of Ferrite, the gap created by the fabric between U- and I-sections can be considered to be an air gap having a length equal to twice of fabric thickness. The inductance is measured by a standard LCRQ bridge having a resolution of 10 µH.

From the scatter plot of the measured inductance (X) and fabric thickness values (Y), it may be observed that a nonlinear inverse relationship prevails between the two parameters. The best fit power equation, which relates the fabric thickness (Y) and inductance (X), is found to be, $Y=8.511X^{-1.435}$. The developed instrument can measure the fabric thickness with very good accuracy.



The measured inductance is observed to be related to the fabric thickness, thus providing a means for measurement.

[#]Contributed by Abhijit Majumdar, Shib Shankar Saha, and Apurba Das, Department of Textile Technology, Indian Institute of Technology, Delhi.

Forthcoming Events

The Open Mechanical Engineering Journal:
Special Issue on Kinematic Design of Manipulators
http://www.bentham.org/open/tomej/Special-Issues.htm

The purpose of this special journal issue is to aggregate papers on design issues for the kinematic design of robots by looking at the different subjects that can define open problems but new solutions both for design procedures and robot architectures. Kinematic design of manipulators can be understood as related to the definition and computation of the kinematic scheme of the structure of a robot, but it is also related to the procedures and algorithms that can be used and elaborated to determine a solution of mechanism schemes and their dimensions for a mechanical design of a robot. Therefore, papers are expected on discussing new structures for robots as based on kinematic aspects but also algorithms for solving design problems for robotic architectures. The numerical aspects can be integrated not only with theoretical arguments but even with practical implementations or laboratory experiments.

We invite authors to presents their results from their activity in original research papers and reviews that can give a survey of the challenging problems and possibilities for the kinematic design of manipulators as well as together their successful applications in new and old areas. Potential topics include but are not limited to:

- Theoretical and computational kinematics for manipulators
- Kinematic design algorithms
- New kinematic design architectures
- Analysis and design of manipulators workspace
- Simulation design procedures
- Industrial and non industrial applications

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Other Events, Select List of Topics, and Websites

Workshop on *Sensor Integration and Data Acquisition in Robotics*
May 21-22, 2010, Chennai, India
Underwater systems; Vision, Micro-sensors and -actuators
http://www.iiitdm.iitm.ac.in/Workshop.html

Workshop on *Microactuators and Micromechanisms*
May 27-29, 2010, Aachen, Germany
Microsystems; Surgical tools; Miniature manufacturing
http://www.igm.rwth-aachen.de/index.php?id=696

European Conference on Mechanism Science 2010
September 14-18, 2010, Cluj-Napoca, Romania
Mechanisms and Machine Science; Robotics; Control
http://www.eucomes2010.utcluj.ro

15th FIRA Robot World Cup and Congress
September 15-19, 2010, Bangalore, India
http://www.fira.in/

DRDO Military Racing Challenge
September 27-29, 2010, Chennai, India
http://www.drdo.gov.in/scomp2010/index.html

IFToMM – Asian Conference on Mechanism and Machine Theory
October 21-25, 2010, Taipei, Taiwan
Mechanisms Design; Microsystems; Biomechanics; Robotics; History of mechanism science; Vehicle design; Education
http://www.asianmms2010.ntu.edu.tw/Call_for_Paper.asp

11th International Conference on
Control, Automation, Robotics and Vision (ICARCV 2010)
December 7-10, 2010, Singapore
http://www.icarcv.org/2010/

INDUSTRY WATCH

Modeling the behavior of solids and system-environment interactions have been longstanding challenge for researchers since it mainly involve the disaggregation and movement of materials. It can be best modeled using discrete element modeling (DEM).

Generally this has been achieved using simplified object shapes like spheres, ellipsoids, rectangular blocks or boxes, etc. Since the computation machines are enhanced over a period of time, the intricate shapes are also used in modeling such as sand granules, food grains, soil lumps, etc. Some of the common examples where DEM can be put to use are, sand granules handling, tire-soil interactions, bulk material handling, food-grain handling, implement-soil interactions, powders like toner movement, etc.

The forces acting on each particle are computed from the initial data and the relevant physical laws and contact models. Generally, a simulation consists of three parts: the initialization, explicit time-stepping, and post-processing. The time-stepping usually requires a nearest neighbor sorting step to reduce the number of possible contact pairs and decrease the computational requirements. This is often performed only periodically. The elements have gravity, contact friction and other cohesive forces acting on them. All these forces are added up to find the total force acting on each particle. An integration method, like Verlet or leapfrog method is employed to compute the change in the position and the velocity of each particle during a certain time step. Then the new positions are used to compute the forces during the next step, and this loop is repeated until the simulation ends.

Most of the time, either the length of simulation or the number of the particles used is deciding factors for DEM due to its computation intensive nature.

Prasad Bhangale, PhD
John Deere Technology Center

NaCoMM 2010 Students' Design Contest

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While S. Ghosh and V. Joshi of IIT Kharagpur Team presented their theme on *dynamic suspension system*, two other teams indeed demonstrated their working model on the floor of the conference. Sucharita R. and P.S. Nanda of NIT Durgapur received the second prize for developing an electro-pneumatic servo system.

When you happen to purchase a UPS or an inverter, one might not wonder if you took home a pneumatic one. The MNIT Jaipur Team consisting of G. Agarwal, A. Bagla, A. Garg, and S. Garg bagged the first prize for their innovative attempt in demonstrating a multi-purpose pneumatic system for households. They presented a pneumatically-driven mechanism that was capable of chopping vegetables even while driving a mixer grinder.

In the era of frequent power cuts and the search for alternative modes of powering automobiles such as using CO_2-driven cars, a deserving effort indeed!

(With inputs from Dr Nirmal Hui, Prof. A.K. Mitra, and Ritwick)

National Symposium on Planar Parallal Robots and Mechanisms

In memory of Late Prof. A.C. Rao, the famous researcher in Mechanisms and Machines, Rungta College of Engineering and Technology, Bhilai, organized the National-level Symposium and Workshop on *Planar Parallel Robots and Mechanisms* during January 7-10, 2010.

The workshop and symposium addressed the theoretical and practical aspects of mechanisms related to real life. Dr. B.K. Sthapak, Vice Chancellor, C.S.V. Technical University, Bhilai, inaugurated the programme. Prof. J.S. Rao, Former Head of the Department of Mechanical Engineering, IIT Delhi, and Prof. B.V.A. Rao, Advisor to Chancellor, VIT University, Vellore, were the guests of honour.

Prof. J.S. Rao delivered the *A.C. Rao Memorial Lecture*. Prof. B.V.A. Rao delivered the keynote address on *Technological Improvements in the field of Mechanical Engineering*. Dr. J. Srinivas of NIT Rourkela delivered a talk on planar robots. The keynote lecture by Prof. S.K. Saha, Professor of IIT Delhi and Vice President, AMM, on *Multibody Dynamics for Rural Applications* drew the attention of many a young mind. Prof Saha, in his lecture, presented several case studies in the development devices relevant to the rural industry, such as the carpet-cleaning machine, sheep-shearing machine and the water lifting gear box. The other highlights of the programme include an inspiring presentation on *RoboCon* (Prof. S.K. Saha), and the presentation on *The Use of Software Prototyping of Various Mechanisms* (Dr. S. Bhoumik, Bengal Engineering and Science University, Shibpur, Howrah).

There were about two hundred participants from the academia and industry from across the country. The symposium received over 80 papers of which a dozen papers were invited for oral presentation. The programme was sponsored by Association of Mechanisms and Machines (AMM). Shri Santosh Rungta, Chairman, Dr. A. Jagdeesh, Director, and Dr. A. Srinath of Rungta College of Engineering and Technology played the lead role in organizing the well-attended event.

Prof. B.V.A. Rao, the founder president of AMM (left) and Prof. S.K. Saha, the incumbent President of AMM, at the AMM event at Bhilai.

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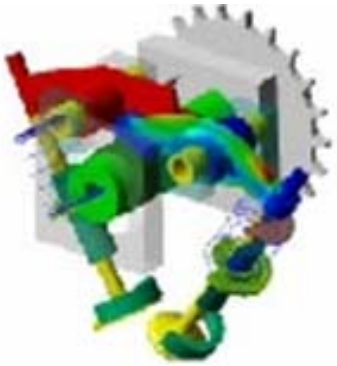

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RecurDyn, based on multi-body dynamics, is the CAE software for multi-physics solutions. Starting with just multi-body dynamics in 2004, **RecurDyn** became the first Multi-Flexible Body Dynamics (MFBD) to integrate multi-body dynamics and non-linear finite element methods into its numerical integrator, which opened the new paradigm in the field of multi-physics CAE.

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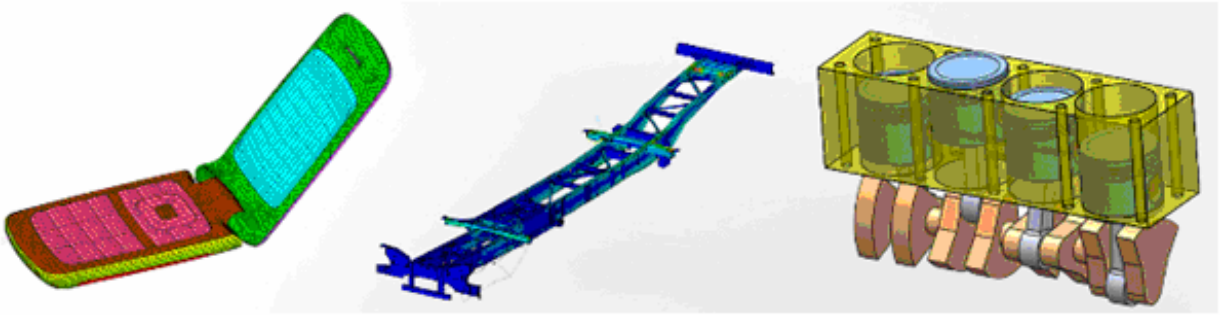

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