

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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Contact Details

Dr. S. Bandyopadhyay

Secretary, AMM

Tel: (044) 2257 4733 (O)

Fax: (044) 2257 4732

E-mail: secretary@ammindia.org

Web Site: <http://www.ammindia.org>

Message from the Editor-in-Chief

Joy of Learning

For last several years, I have been focusing on how to make learning, be it in engineering or school-level, a fun activity rather than considering it a burden. To me, an education is fulfilling and rewarding in terms of getting a good job or getting a promotion or getting a publication accepted for a researcher, etc. if it is done with interest and probably in a fun way. I must admit that it did not happen to me during my school days or even in the college-level mainly because for me then it was just a mechanism to get a job or a mean to earn for living.

Recently, being in the teaching profession for last 17 years, I find that even teaching is not interesting unless I do it in a fun way. Sometimes, my family members at home complain about why I read technical matters at home or work with computer most of the time. My answer has been simple, “when we human beings are not slipping, eating, playing, doing physical exercises, etc., we do something. We watch television or we play games or we talk about people (good and bad), etc. For me, studying and working with computer (not in the Facebook all the time though!) are an entertainment, particularly, realizing the fact that it also gives me money for living. Hence, the better I do, better I enjoy the work, and my boss is happy who may in turn promote me faster or reward me in some other form.

Anyway, in this column I wanted to share some of my personal experiences at IIT Delhi to make learning a fun activity.

- The first experience is with the undergraduate students. They have been taking part in a robotics competition since 2003. In these competitions, students need to design robots based on the game plan given by the organizers about 6-7 months in advance. Mechanical, Electrical, Computer Science and Engineering, and other students from almost every year of undergraduate-level take part in the design, making CAD drawings, fabrication, programming, debugging, etc. in order to stage their robots at the competitions. They have to distribute the work responsibilities and manage the fund as well, which certainly expose them to some aspects of management. The details of the activity appeared in the AMM’s news bulletin issue of Oct. 2011 (Vol. 3, No. 4, Title: *Innovative Teaching and Research*). One comment from an academically weak student whom I asked not to participate in those competitions and concentrate on his studies was, “this is the only think I enjoy at IIT Delhi.” Of course, his performance was improved subsequently.
- In order to extend the above experiences to the school-level, workshops in the form of exposing school students (sometimes varying from Class 4 to 12) in assembling small toy cars consisting of wheels, electric motors, batteries, screws, metal plates, etc., and making circuits by soldering wires with switches to control the above cars were conducted. The competition with those cars at the end of workshops where the students see their creations working is a true joy to the parents and the teachers around them. A typical comment from a Class IX student was, “I learnt resistance, saw many instruments and how to use them and put love and skill together to expect a masterpiece.” Is not amazing?

Through this column, I wish the readers to appreciate the above approach of education, and either experiment with it or carry forward the message to the appropriate forums. I am sure this will enhance the level of quality of education in India, which is generally felt missing even though the degrees are awarded, and the skills that have been the focus of the Government of India in recent times.

Subir Kumar Saha
Editor-in-Chief

Simulation of 4-bar Mechanisms in Flash

Shamanth Hampali, B. Tech. Student, NITK Surathkal

The aim of this article is to present a developed computational program for computer graphic modelling of planar mechanisms. In order to demonstrate the functionality of the program, a 4-bar mechanism is considered. The project was done for SOLVE (Students Online Laboratory through Virtual Experimentation), a virtual lab at NIT Karnataka, Surathkal under the supervision of Dr. K.V. Gangadharan. Many such programs on different mechanisms can be accessed freely at www.solve.nitk.ac.in. These programs enrich the learning experience through experimental learning of science, engineering and technology in a virtual learning environment at preferred location, time, and pace. The program is built in Adobe Flash environment using Actionscript 3.0 language which enhances the user interface and makes the animation smooth and beautiful. The program can be run on any system in the default web browsers and will not require any sort of software installation. The 4-bar mechanism program is divided into several subdivisions, which are explained below.

Analysis: Position, velocity, acceleration, and dynamic force analyses for any class of 4-bar mechanism can be performed along with the corresponding vector diagram representation. In dynamic analysis, the driving torque is calculated, and graph is plotted.

Coupler curve (Fig. 1): The coupler curve can be generated for any desired coupler point for all class of 4-bar mechanisms. The colour of the curve changes for any modification made in the configuration, which enables the user differentiate between the curves.

Special mechanisms: Five approximate straight line generating 4-bar mechanisms (Chebyshev, Hoeken's, Evan's, Robert's and Watt's) and a symmetric linkage are preloaded into the program.

Since input through mouse enhances the level of understanding and the interaction with the program, the crank can be rotated using the mouse

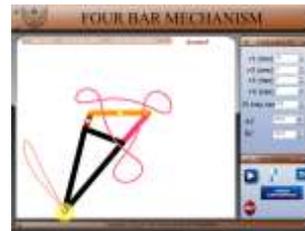


Fig. 1: Coupler curve



Fig. 3: Inverse dynamics



Fig.2: Velocity/acceleration

to any desired angle and corresponding analysis along with its vector representation are obtained. Such type of inputs (like drag and drop) is implemented throughout the program wherever possible. Tooltip is provided for every control which makes it self-explanatory for the user.

The underlying algorithm of the 4-bar program is based on graphical approach and the calculations involved in velocity and acceleration analyses (Fig. 2) are done by primarily finding the instant centre of the floating link. For inverse dynamics, *D'Alembert's* law was followed to get the driving torque (Fig. 3). The calculations involved in the dynamic force analysis were verified with the ReDySim software (<http://www.re dysim.co.nr>).

Further the program can be improved by implementing synthesis of mechanism and preloading more templates to "special mechanisms" section. A separate module for plotting dynamic graphs can be built where the velocity, acceleration, force/torque for different joints and links can be represented. Optimisation of the code is very essential as it is always a major concern to reduce the overall size of the output file and the computation involved so that it can be quickly downloaded and easily run on any low cost tablets and phones. These will be done in future.

Forthcoming Events

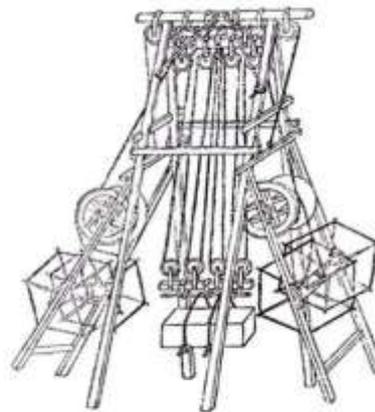
Objectives

Biannual international conferences IMSD and ACMD aim to bring together researchers in multibody dynamics from both academia and industry and to promote opportunities to exchange cutting-edge information on the theory and application of multibody systems. As one of the rapidly growing branches of mechanical engineering, the multibody system dynamics is applied to various applications, and is becoming increasingly important in the development of complex engineered systems. The IMSD and ACMD will provide a unique opportunity to identify the current challenges, share solutions, and promote friendships between the two multibody dynamics communities.

The topics of the conference include, but are not limited to:

- Algorithms, Integration Codes, and Software
- Biomechanics
- Contact and Impact Problems
- Control and Mechatronics
- Dynamics of All Vehicles
- Dynamics of Machines and Rotating Structures
- Efficient Methods and Real-Time Applications
- Flexible Multibody Systems
- Multidisciplinary Approaches
- Modeling, Formalisms, and DAE solution method
- Optimization, Sensitivity Analysis and Parameter Identification
- Robotic Systems
- Theoretical and Computational Methods
- High Performance Computing
- Multibody Applications, Experiments and other topics

First Announcement and Call for Papers



The 3rd Joint International Conference on IMSD
Multibody System Dynamics

The 7th ACMD 2014
Asian Conference on Multibody Dynamics

Busan, Korea,
June 29 – July 3, 2014

For more information
<http://www.acmd2014.konin.or.kr/>





National Conference on Industrial Problems on Machines and Mechanisms (IPRoMM-2014)

February 26-27, 2014

Organized by Mechanical Engineering Department
ITS Engineering College, Greater Noida (UP)
in association with
Association for Machines and Mechanisms (AMM)

The conference on Industrial Problems on Machines and Mechanisms (IPRoMM) 2014 is one of the series of national events organized biannually under the aegis of Association for Machines and Mechanisms (AMM), an affiliate of the International Federation for the Promotion of Mechanism and Machine Science (IFTToMM), on different themes of interest of industrial problems on machines and mechanisms. Realizing the vicinity of ITS Engineering College, Greater Noida to automobile industry and those associated with Agricultural Machines and Human Orthopaedic Support systems, the theme of this conference has been chosen as **CAD Simulations in Automobile and Allied Industry**. The aspect of Computer Aided Design (CAD) simulations has been chosen as it is an almost indispensable component in today's design and analysis of almost any system, particularly, in automobile designs, vehicle and crash simulations, safe vehicle designs, driver simulators, biomechanics, etc.

In order to attract the experts from the specific industry it is planned to have keynote lectures by engineering heads of different companies around the National Capital Region (NCR), and the panel discussion bringing industry and academia together. Academicians working in the CAD design and simulation of automobile components and allied areas are encouraged to submit papers to report their case studies and applications of their theories. Students working in these areas, e.g., simulating vehicles or their components to have an energy-efficient system or sub-system, are also encouraged to submit posters so that the young talents are exposed to the industry experts. Keeping in mind the above theme and objectives, the conference will accept papers and posters in the following areas:

- Mechanism analysis and synthesis for automobiles; Mechatronics for improved performance and safety of vehicles; Automotive Chassis; Noise, Vibration and Harshness in Automobiles; Balancing of Vehicle Components; History of Automobile Machines and Mechanisms; Application of FEM in Vehicle Design, Crashworthiness, etc.; Multibody System Modelling for Vehicles; Drivers' Simulators
- Mechanisms and Machines for Rural, Agricultural and Industrial Applications
- Bio-medical Devices and Mechanism Kinematics
- Students' Competitions on Vehicles, etc.

Abstract Submission

Abstracts not exceeding 200 words on any of the aforesaid themes should be sent to the convener through email at ipromm2014@its.edu.in latest by **August 31, 2013**.

Submission of Full Paper

Full length papers should be submitted as an attachment in MS-Word following the format to be available through www.ipromm2014.org.

Call for Posters

Students and research scholars may present their paper as posters during the conference, bringing out their innovation in the field of CAD simulations of mechanisms for industries. For more details and updates, please visit www.ipromm2014.org.

Papers, posters and filled-in registration form along with the participation fee should be sent to:

Prof. S.S. Chauhan, Convener – IPRoMM 2014
Mechanical Engineering Department
ITS Engineering College, 46, Knowledge Park-III
Greater Noida-201308 (UP)
Tel: +91-9891 103 337
Email: ipromm2014@its.edu.in, sschauhan@its.edu.in

Important Dates

Submission of Abstract: **Aug. 31, 2013**
Acceptance of Abstract: **Sept. 15, 2013**
Submission of Paper: **Nov. 30, 2013**
Notification of Decision: **Dec. 31, 2013**
Camera-ready Papers: **Jan. 20, 2014**
Last date of Registration: **Feb. 15, 2014**

SIOMMS 2013

October 12-13, 2013 Shanghai, China

**2nd Students International Olympiad on Mechanism and
Machine Science**

<http://siomms2013.sjtu.edu.cn/>

Shanghai Jiao Tong University (SJTU) is pleased to invite university teams to participate in Students International Olympiad (SIO) on Mechanism and Machine Science (MMS) that will be held on October 12-13, 2013. This second global Olympiad will be arranged following the decision of the Executive Council of International Federation for the Promotion of Mechanism and Machine Science (IFTToMM).

The problems on the following topics will be proposed at the Olympiad.

- Structural analysis and synthesis of mechanisms
- Kinematics of flat mechanisms
- Force analysis of mechanisms
- Kinematic analysis of cam mechanisms
- Gearing (kinematics, geometry, efficiency)
- Adjustment of dynamic characteristics, mechanical governors
- Balancing of rotating masses

Student Mechanism Design Contest for Students

<http://www.nacomm2013.org/contest.html>

One of the key objectives of the Association for Machines and Mechanisms (AMM) is to promote innovation among the students. Towards this end, a mechanism design contest has been made an integral part of NaCoMM series of conference since 2009. This year also the competition will be held during the 1st International and 16th National Conference on Machines and Mechanisms (iNaCoMM-2013) during Dec. 18-20, 2013. The purpose of the competition is to encourage the students to apply their theoretical knowledge in the domain of mechanisms and machines to solve problems relevant to the society.

Participants must submit a 2-page proposal by **September 15, 2013**, outlining the design challenge and novelty/innovation of the proposed design. Submissions should be done through email with the subject line: Proposal for the Students' Mechanism Design Contest, to the following address: inacomm2013@iitr.ernet.in.



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<http://www.functionbay.co.kr>

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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Contact

Delhi : B. Sridhar - 98110 68096
Chennai : S. Nakkeeran - 98400 46560

Editorial Board

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