

# 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

Greetings to all the readers of the AMM News Bulletin!

First, I would like to share my happiness to be in the AMM (a prestigious body in the area of Mechanical Engineering in India) as the Zonal Vice-President (South).

In this issue, I would like to bring to your attention various activities that are taking place in the area of Machines and Mechanisms.

This year "PRODIGY'12" was organised by Production Engineering Association, National Institute of Technology (NIT), Tiruchirappalli. It was held in March 2012. A detailed report included inside this News Bulletin.

An interesting inter-departmental "Vibration Group" was formed at IIT Delhi where the faculty and students of mainly Mechanical and Civil engineering departments came together to share their research experiences. An article on this is also reported in this issue.

At the end, I urge all the AMM members to contribute to the AMM News Bulletin regularly, as this is a major source of information for the AMM members.

**Dr. K. PANNEERSELVAM**  
Zonal Vice-President (South)

## WELCOME TO NEW ZONAL VICE-PRESIDENT (SOUTH)

On behalf of the AMM and the readers of its News Bulletin it gives me an immense pleasure to welcome Dr. K. Panneerselvam, Assistant Professor in the Department of Production Engineering at N.I.T. Tiruchirappalli as the Zonal Vice-President (South) of AMM. I hope he as the Editor-in-Chief of the April issue will be able to take our News Bulletin to greater heights.

Prof. S.K. Saha, Patron

## CAD/CAE Simulations of Mechanisms and Robots

Shivesh Kumar, B. Tech. Student, NIT Suratkal

Robot is a mechanical device with various degrees-of-freedom and hence it is a multi-variable, multi-parameter, non-linear system. Hence, their kinematic and dynamic analyses are complex and difficult for solving. Also, it is very difficult for beginners to learn and visualize how these devices would perform under certain dynamic conditions. Computer simulation serves to be of great help while analyzing such systems.

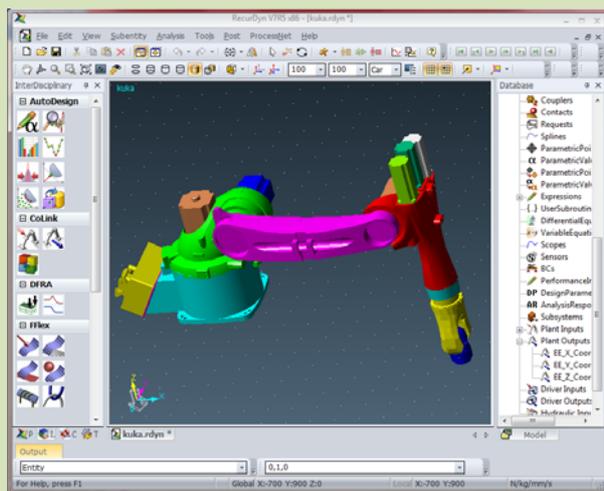


Fig 1: KUKA KR5 Robot Model in RecurDyn

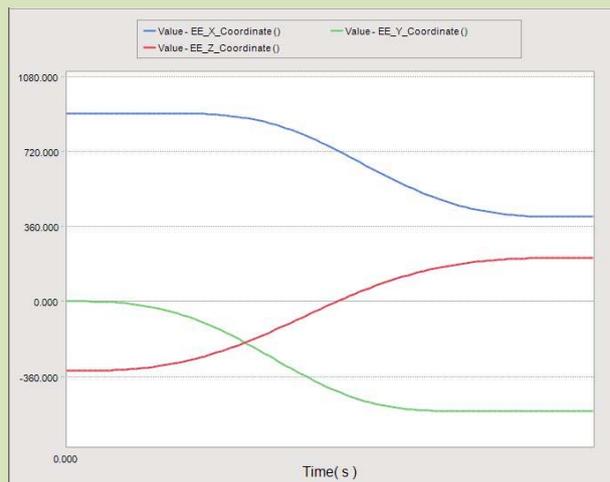


Fig.2: End-effector Coordinates

In this study, various mechanisms like four-bar mechanism, slider-crank mechanism, Scotch-yoke mechanism, elliptical trammel mechanism, cam-follower mechanism, IC Engine, Lawn-mower mechanism, etc., and robots like PUMA-560, Stanford Schienman arm, KUKA KR5 etc. were modeled and simulated using two commercial software, namely, RecurDyn and Autodesk Inventor. The design data was first collected from various websites/textbooks and the solid-modeling of these mechanisms was performed. In some cases, the dimensions were suitably assumed due to unavailability of the design data. After the solid-modeling was done, the kinematic and dynamic simulations of these robots/mechanisms were performed by defining different kinematic constraints such as joints, solid contacts etc. and suitable dynamic conditions were further applied. For example, Figure-1 shows KUKA KR5 robot whose model was imported into RecurDyn. After defining kinematic constraints for the robot, cycloidal trajectories were provided at each joint and the behavior of the robot was analyzed. Figure 2 shows the variations of the end-effector coordinates v/s time. A similar simulation was performed in Autodesk Inventor as well. The results were compared for verification.

Since, the control system design of a robot is an important aspect of robot design the control system simulation was also performed using the Colink toolkit available in RecurDyn software. The control system of KUKA KR5 robot was designed in Colink and the dynamic co-simulation of the robot was performed. For the beginners, video tutorials of how to model the above mechanisms and robots are available at

<http://www.youtube.com/user/robotsinmotion>.

This work was done in the summer of 2011 during the internship at IIT Delhi in Mechatronics Lab. The author sincerely acknowledges the guidance of the lab members and the financial support from Function Bay Dynamics, India.

## Vibrations Group@IIT Delhi

Prof. S.P. Singh, Department of Mechanical Engineering, IIT Delhi

With the purpose of synchronization of activities related to research in Vibrations, Dynamics and Acoustics and for cross-fertilization of ideas, Vibrations Group has been set up at IIT Delhi. The group comprises of the students, researchers and faculty of IIT Delhi engaged in research activity related to Vibrations and Dynamics. In the first meeting of the group under the chairmanship of Prof. K. Gupta, various activities were chalked out for the group. It was decided to exchange the expertise by way of members presenting their current work in the form of seminars. A fortnight later, the first seminar was delivered by Prof. T.K. Datta on "Random Vibrations and Stochastic Dynamic Control." Prof Datta explained about the different control schemes which are being tried out for active control of Civil Engineering structures and off-shore structures primarily for the purpose of making our buildings and structures earthquake resistant. Since a large class of systems and structures are actually stochastically excited, it is imperative to include the stochastic nature as a part of the control action. This is a very recent advancement in control literature. Prof. Gupta stressed on the need for continued interactions and problem solving sessions. The research students were also encouraged to present their work.

It is felt that such group will cross-fertilize ideas and strengthen the research activities in the campus. In order to enhance the research activities in other institutes/colleges, mainly, those who are aspiring to get into research domain may adopt such scheme and can share their experiences with us if it is particularly in the area of Vibration and Dynamics.



## 16<sup>th</sup> National Conference on Machines and Mechanisms Indian Institute of Technology, Roorkee December 2013

Department of Mechanical & Industrial Engineering, IIT Roorkee, under the aegis of Association for Machines and Mechanisms (AMM), and International Federation for the Promotion of Mechanism and Machine Science (IFTOMM) is organising NaCoMM 2013 at IIT Roorkee. The conference aims at bringing together researchers, industry experts and students interested in various aspects of design and analysis of machines and mechanisms. The conference will also have key note lectures and students mechanism design contest.

### About Roorkee

Roorkee is in the State of Uttarakhand and is located at the foothills of Himalayas. It is blessed with the holy Ganges Canal flowing through the centre of the city. The nearest airports to Roorkee are Dehradun & Delhi. Roorkee Railway Station is on the main line of Northern Railways having direct links to Delhi, Mumbai, Kolkata, Amritsar, Jodhpur and Ganganagar. The place is also within easy reach from Delhi, by road (180 km) and is located on Delhi - Haridwar and Delhi - Dehradun bus routes. Roorkee is ideally located near several tourist places like Dehradun (70 km), Mussoorie (100 km), Haridwar (32 km) and Rishikesh (52 km). The month of December falls in winter season with temperature ranging between 10-20 degree C.

### Topics

Analysis and Synthesis of Mechanisms  
Compliant Mechanisms  
Design and Analysis of Biomedical Devices  
Dynamics and Control of Multi-body Systems  
Dynamics and Vibration Analysis in Machines  
Fault Diagnosis and Health Monitoring  
History of Machines and Mechanisms  
Mechanisms and Machines for Rural, Agricultural and Industrial Applications  
Mechatronic Systems  
Micro-, Nano-Machines and Mechanisms  
Modeling and Simulation  
Robotics  
Theoretical and Computational Kinematics  
Tribology  
Vehicle Dynamics

### Publication

Based on three peer reviews, some papers will be accepted for presentation and some more for poster presentation. Selected papers would be published in the IFTOMM's scientific journal, Mechanism and Machine Theory.

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## PRODIGY'12

**Dr. S. Vinodh, NIT Tiruchirappalli**

PRODIGY'12 is a national technical symposium organised by Production Engineering Association at NIT Trichy-15. This symposium is a confluence of young engineering brains from all over the country, to discuss and disseminate constructive ideas. Spanning two days, it will be a fruitful technical concourse on a plethora of topics ranging from Manufacturing to Management to Information Technology. One of the highlights of PRODIGY'12 organised by Production Engineering Association, NIT Tiruchirappalli was the Panel Discussion Session. This event was conducted to enumerate the key issues of the state of "Engineering Education in India," a topic pertinent to the students and faculty alike. The panel included distinguished speakers with vast experiences in their respective fields. They included Dr. Bhaskaran, Deputy Director of Industries and Commerce, Tamil Nadu, Mr. Mano Kanthanathan, Business Development Head for FLEXSIM, India, Dr. Godwin Tennyson, Professor in the Indian Institute of Management Trichy, and Dr. P.S.S. Prasad, Professor from PSG Technology Coimbatore.

The discussion was highly interactive and saw participation from students from NIT-Trichy as well as other colleges. The discussion brought different views on the topic; however the panellists were unanimous on the importance of incorporating industrial exposure along with the academic curriculum. Other excerpts included the introduction of more internship options, flexibility in choosing the curriculum and increased student-faculty interaction.



A session during PRODIGY'12

A workshop on CNC machines called "Machinatrix" was also organized during PRODIGY'12. This workshop saw huge registrations online and was attended by about 150 students from various colleges in and around Tamil Nadu. The workshop included a seminar on the basics of CNC. Numerical control concepts, Part programming, Introduction to programming languages like Sinumerik and Fanuc were covered in the seminar. It was followed by lab session in which participants practiced two exercises in manual part programming in our simulation lab. The software simulation enabled them to have a better understanding of the concepts. After this, in teams of three, they carried out the exercises in our CNC lab. They implemented their own manual part program codes. Thus, this workshop gave them a good exposure on CNC concepts. They not only acquired knowledge but also practiced what they learnt. Demonstration of MIKROTOOLS multipurpose micro machine was also there so that they would be able to appreciate the applications of CNC machines even in micro domain fabricating intricate components.

# Association for Machines and Mechanisms

## Membership Information

**Application process for the membership of the Association for Machines and Mechanisms is now web-based. Please read the instructions below and fill-up the web-form to apply.**

### Step 1:

Please choose the membership category from:

1. Life membership for individuals (membership fee: Rs. 1575/-)
2. Corporate membership (membership fee: Rs. 15750/-)

Student membership has been discontinued for the time being. However, interested candidates may always apply for life membership.

### Step 2:

Please make a cheque/draft in favour of “ASSOCIATION FOR MACHINES AND MECHANISMS” payable at the State Bank of India, IIT Madras branch (A/c No. 10620822080), Chennai, India, before filling the form. The payment details would be needed to complete the form.

### Step 3:

Please fill in the **web-form** carefully. Check for the correctness of the data before submitting the form. Please note that the form does not store any data unless it is submitted. As such, you would need to complete it and submit in a single session.

### Step 4:

Once you submit the form, you will receive an email with the details entered by you. Kindly print the same, and sign it. If you find any error/incompleteness in the data, please mark the corrections on the hardcopy itself. We shall incorporate these changes in the database on your behalf. **Please do not fill-in another form, as it would create a duplicate entry in the database and create confusions.**

### Step 5:

Please send the signed hardcopy of the registration email and cheque/draft to the address given below. These documents (except for the bank draft) can also be scanned and emailed to [secretary@ammindia.org](mailto:secretary@ammindia.org) with the subject line "AMM Membership Application". Please note that applications are processed in batches, and hence take 2-3 months depending of the rate of receipt of applications.

Address for sending the signed forms:

Dr. Sandipan Bandyopadhyay  
Department of Engineering Design  
Indian Institute of Technology Madras  
Chennai 600 036, India



FunctionBay, Inc.



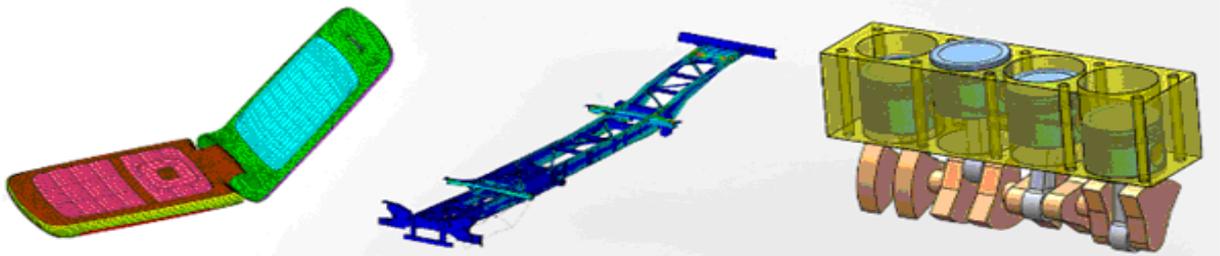
<http://www.functionbay.co.kr>

**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.

Today, **RecurDyn** continues to lead the multi-physics CAE field by creating inter-disciplinary CAE software that integrates MFBD, Lubrication, Control, and Design Optimization, all in a single framework.

**Function Bay Dynamics (I) Pvt. Ltd.**  
**(Contact: B. Sridhar - 98110 68096)**  
**301 Odeon Plaza, II Sector, 10, Dwaraka, New Delhi 110075**

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