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

Software for Multibody System Simulation

As the world's most famous and widely used Multibody Dynamics (MBD) software, ADAMS by MSC Software improves engineering efficiency and reduces product development costs by enabling early system-level design validation. Engineers can evaluate and manage the complex interactions between disciplines including motion, structures, actuation, and controls to better optimize product designs for performance, safety, and comfort. Along with extensive analysis capabilities, ADAMS is optimized for large-scale problems, taking advantage of high performance computing environments. Utilizing multibody dynamics solution technology, ADAMS runs nonlinear dynamics in a fraction of time. Loads and forces computed by ADAMS simulations improve the accuracy of any Finite Element Analysis (FEA) by providing better assessment of how they vary throughout a full range of motion and operating environments.

Altair® MotionSolve® is another integrated solution to analyze and optimize multibody system performance. Through extensive customer partnership, MotionSolve is thoroughly validated for quality, robustness and speed. Based on superior numerical methods and scalable formulations, MotionSolve offers powerful modeling, analysis, visualization and optimization capabilities for multi-disciplinary simulations that include kinematics and dynamics, statics and quasi-statics, linear and vibration studies, stress and durability, loads extraction, co-simulation, effort estimation and packaging synthesis. Customers worldwide, in a wide range of industries from Automotive, Aerospace, Construction equipment to general machinery successfully use MotionSolve. MotionSolve's Pre/Post (MotionView) provides users an easy-to-use, robust modeling environment to model and optimize system performance.

Other noticeable software includes: RoboAnalyzer and ReDySim by IIT Delhi, India; RecurDyn by Function Bay Inc., Korea; Universal Mechanism by Bryansk State Technical University, Russia; Alaska by Tech. Univ. of Chemnitz; CAMeL-View by IXtronics GmbH; NEWEUL by University of Stuttgart; SIMPACK by INTEC GmbH (Four from Germany); TRUE by True-World, France; AVL EXCITE by AVL, Austria; COMPAMM by CEIT, Spain; LMS Virtual Lab Motion by LMS; MECANO by Samtech; MBSoft by Universite Catholique de Louvain; Robotran by Universite Catholique de Louvain, Belgium (Four from Belgium); SAM by Artas Engineering Software; SPACAR by University of Twente (Both from The Netherlands); Dynawiz by Concurrent Dynamics Int. MBDyn by Politecnico di Milano, Italy; MapleSim by Maplesoft, Canada; AUTOLEV by OnLine Dynamics Inc.; AutoSim by Mechanical Simulation Corp.; Autodesk Inventor; SD/FAST by PTC; Simbody by Simbios; SimCreator by Realtime Technologies Inc.; SimMechanics by Mathworks; Working Model by Knowledge Revolution (Eight from the USA)

It is expected that today's engineers will be able to design their products much faster than ever before provided they take advantages of the above simulation tools.

Himanshu Chaudhary, Editor-in-Chief

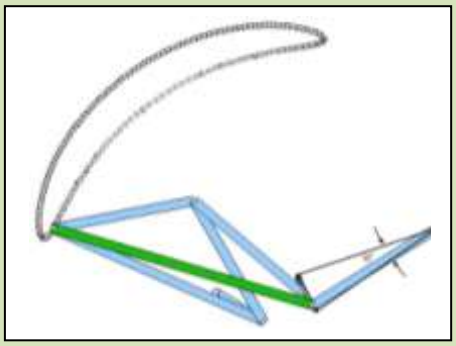
Contribution of NIT Hamirpur Students (UG) in Mechanism-based Projects

Rajesh Sharma, Mechanical Engg. Dept, NIT Hamirpur

To inculcate interest in the UG students towards mechanisms, they are motivated to undertake various projects under the guidance of the author. This page carries one such attempt of Mr. Tanmay Agrawal and Mr. Kushagra Upadhyay. The students have carried out synthesis and simulation of an Adjustable Six-bar Linkage. Such linkages find applications at various places to transfer and transform motion wherever dwelling is required.

The six-bar linkage acts like a dwelling mechanism in different configurations. Figures 1 and 2 show their configurations. The coupler curve and output profile of Configuration 1 are also shown in Fig. 1. By changing the location of joint between coupler link and output link, the two configurations can be achieved. Such linkages were synthesized using the knowledge of coupler curve atlas, synthesis of four-link system, and geometry. Simulation was done on CATIA V5R20 and Working Model 2D. However, MATLAB was used to obtain various plots and coupler curves to make the synthesis possible**.**

Configuration 1 in Fig. 1 finds applications in assembly line with certain auxiliary parts, as in a stamping machine etc., whereas orientation 2 is popularly used as a windshield wiper of a car. In addition to output link, coupler point also traces a special path which in turn finds application in robotics.



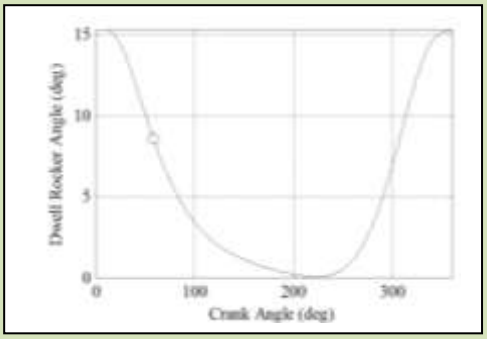


Fig 1: Configuration 1 with its input and output variation

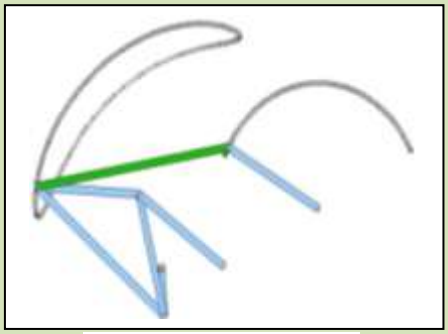


Fig 2: Configuration 2

Forthcoming Event

Objectives

Biannual international conferences IMSD and ACMD aim to bring together researchers in mulitbody dynamics from both academia and industry and to promote opportunities to exchange cutting-edge information on the theory and application of mulitbody 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

Report of the Workshop on Trends in Teaching Robotics

Majid Hameed Koul, Research Scholar, IIT Delhi

On December 22, 2012, a workshop on Trends in Teaching Robotics to UG/PG Students was held at IIT Delhi. The workshop was sponsored by CD Cell (QIP) of IIT Delhi and spearheaded by Prof. S. K. Saha, Department of Mechanical Engineering. The aspiration of the workshop was to discuss and develop a curriculum for the Robotics course typically offered to UG/PG students at different engineering colleges in India. Focus was on how to attain synergy between the theory and practicality in robotics. Keeping these objectives, academicians from elite institutions in India, book publishers, and scholars shared the common platform.

Course Structure

Based on the discussions and the presentations by different participants, a typical course structure was formulated which could be adopted/incorporated by any technical institute or university for teaching Robotics. It was agreed that the courses must contain the basic kinematics and dynamics content, apart from just understanding the hardware components of Robots. Detailed course structure is available in the workshop's report*.

Books

It was suggested that a book should be prescribed as a text book which the students must follow closely. Other books could be considered as supportive books for some topics which may not have covered in the textbook. Some of the typical books suggested for teaching Robotics have been listed in the workshop's report as well.

Software

It was unanimously agreed that a course on Robotics must use one or more software to not only visualize the motion and characteristics of robots but also to analyze/synthesize/design robots for a given application (say, as class projects). The software could also enable understanding the physics behind the robots. Typical software could be RoboAnalyzer, Virtual Labs, Mathematica, MATLAB, MultiBondgraph, ADAMS, RecurDyn, etc.

Hardware and Projects

All the presenters and participants felt that "project-based" (for example, building robots and developing hardware and software for competitions or otherwise) teaching should be emphasized so that students can not only understand the theory taught in the classes but also enjoy the subject. This will also build their confidence in the subject. Finally, it will also impart hardware skills which will enable them to become even an entrepreneur in case they find industry is not for them.

Finally, as per the suggestions given by some of the participants, the workshop report was sent to all the participants (about 30) and to the Directors of those institutes/colleges where Robotics courses are usually offered (about 100). The report was also sent to AICTE, MHRD and UGC in order to help those organizations in framing policies for the teaching/learning of the subject. Other suggestions like inviting industry people for the discussions etc., would be taken care off in future, or would be passed on to those who would conduct such workshops in the coming days.

**The complete report is available online at: http://www.roboanalyzer.com/workshop.html*

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.

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