Workshop on Dynamics of Serial-chain, Tree-type, and Closed-loop Robotic Systems

Abstract:

In this workshop, general approaches like Euler-Lagrange and Newton-Euler for the dynamics modeling of a robotic system will be explained. It will be followed by the introduciton of the concept of Decoupled Natural Orthogonal Complement (DeNOC) matrices for the dynamic modeling of serial-chain robotic systems, which was proposed by the speaker in 1995. Its benefit in writing the analytical expressions for the elements of the associated matrices will be highlighted, before presenting the recursive algorithms for inverse and forward dynamics. Such algorithms are not only computationally efficient but also numerically stable. Later, the concept of the DeNOC will be extended to model tree-type and closed-loop robotic systems. All these steps will be explained using several case studies like serial-chain industrial robots, tree-type walking robots, closed-loop Stewart platform, etc. The results were generated using in-house software like RoboAnalzyer and ReDySim. In order to make both the software available free to the students, faculty and researchers of the World, a website http://www.roboanalyzer.com was created. At the end, steps to model flexible-link systems using the DeNOC matrices will also be summerized.

About the Speaker:

Prof. Subir Kumar Saha, a 1983 mechanical engineering graduate from the RE College (Now NIT), Durgapur, India, completed his M. Tech from IIT Kharagpur, India, and Ph. D from McGill University, Canada. Upon completion of his Ph. D, he joined Toshiba Corporation's R&D Center in Japan. After 4-years of work experience in Japan, he has been with IIT Delhi since 1996.

He is actively engaged in teaching, research, and technology, and completed projects worth more than USD1.0 million. He established the Mechatonics Laboratory at IIT Delhi in 2001. As recognition of his international contributions, Prof. Saha was awarded the Humboldt Fellowship in 1999 by the AvH Foundation, Germany, and the Naren Gupta Chair Professorship at IIT Delhi in 2010. He has been also a visiting faculty in Canada, Australia, and Italy. Prof. Saha has written several books. A text book on "Introduction to Robotics" published by McGraw-Hill in India and Singapore. It was also translated in Mexican Spanish. To make robotics learning fun, a software RoboAnalyzer was developed under his supervision. He has co-authored two more books with two of his ex-Ph. D students, 1) "Dynamics of Tree-type Robotics Systems"; and 2) "Dynamics and Balancing of Multibody Systems." Both were published by Springer. He has more than 175 research publications in reputed journals/conference proceedings, and delivered more than 150 invited/keynote lectures in India and abroad.

Prof. Saha's two special interests are: 1) innovative research by converting rural problems into research topics; and 2) an innovative teaching methodology by making students taking part in robotic competitions.

Participants are encouraged to download the above two software for effective practice during the workshop and effective learning of the topics.