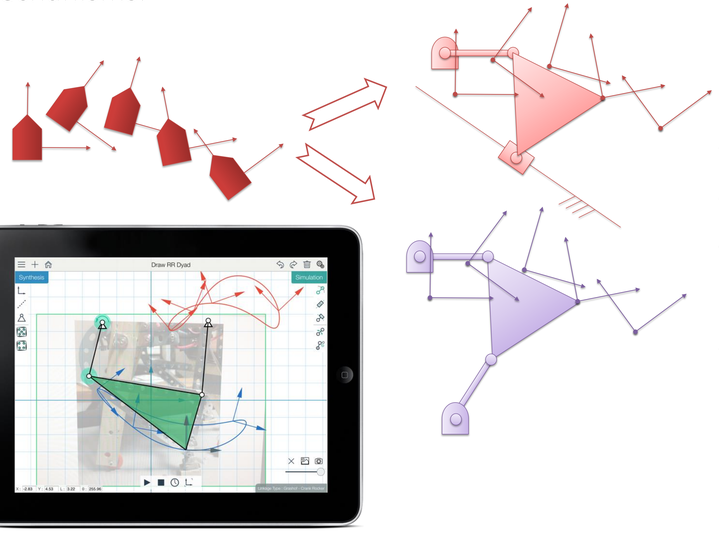
Data-Driven Kinematic Synthesis of Mechanical Motion Generating Devices

A short-term course sponsored by Global Initiative Of Academic Networks, Ministry of HRD
Indian Institute of Technology Ropar, December 21 – 31, 2016

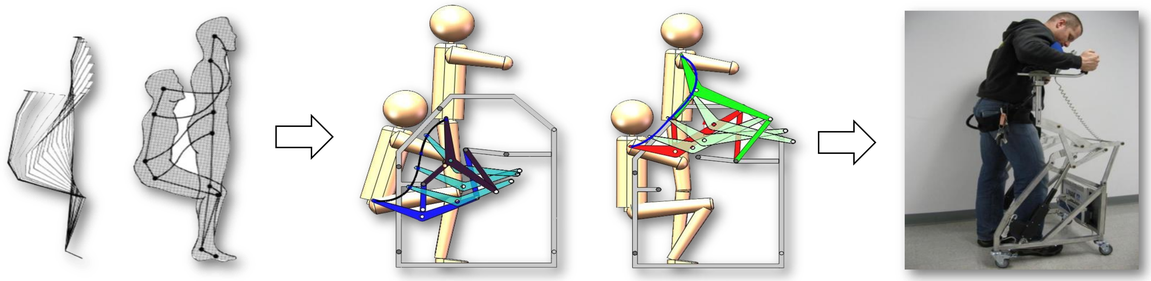
Overview

This course would introduce participants to a data-driven paradigm for kinematic synthesis of mechanical motion generation devices. The goal is to advance the science of mechanism design and lead to practical and efficient design tools capable of solving highly complex motion generation problems faced by machine designers.

This recently developed paradigm brings together diverse fields of Reverse Engineering, Computational Shape Analysis, and Design Kinematics to creation of a new computational framework for simultaneous type and dimensional synthesis of various mechanisms. This includes (1) the development of unified versions of design equations that span broad classes of mechanisms; and (2) the development of unified algorithms for data-driven simultaneous type and dimensional synthesis of mechanisms.



Applications: Real-life Device Design



Sit-to-Stand Motion | Hip lifting Motion | Shoulder lifting Motion | Patented Prototype

Prof Anurag Purwar
State University of New York at Stony Brook, NY

Dr. Anurag Purwar is a research associate Professor of Mechanical Engineering and Director of Computer-Aided Design Innovation Lab at Stony Brook University. He received his Ph.D. from State University of New York at Stony Brook and his B. Tech from Indian Institute of Technology, Kanpur, both in Mechanical Engineering. In the past 10 years, he has conducted more than 100 projects with a cumulative funding of close to $3M. He won a SUNY Research Foundation Technology Accelerator Fund (TAF) award which enabled him to develop a multifunctional Sit-to-Stand-Walker assistive device. Dr. Purwar gave **a TEDx talk** on Machine Design Innovation through Technology and Education. (https://www.youtube.com/watch?v=iSW_G0nb11Q)

Course Topics

1. *Quaternions, biquaternions, and dual quaternions; Clifford Algebra*
2. *Linear, affine, and rigid body transformations*
3. *Projective geometry; Homogeneous coordinates*
4. *Kinematic mapping; Application of rigid body kinematics to the NURBS geometry*
5. *Current paradigm of linkage synthesis*
6. *Task-driven unified representation of kinematic constraints for linkages*
7. *Exact and approximate synthesis of planar linkages with revolute and prismatic joints; Synthesis of spherical and spatial linkages.*

Dr Ekta Singla
Mechanical Engineering Department, IIT Ropar

Dr Ekta Singla is an assistance professor at IIT Ropar. Prior to this, she was a research associate at ISIR, University of Pierre and Marie Curie, Paris, and worked for an evolutionary design of a robotic arm for cluttered environments. Recipient of National Award, Institute of Engineers, National Doctoral Fellowship (AICTE) during her PhD from IIT Kanpur and Institute Gold Medal during Masters, she has contributed in the kinematic synthesis, motion planning and development of redundant robotic arms for constrained workspaces.

Her current research interests inclined towards the task-oriented designs of robots using modular approach and for an assistive tool for task-oriented type synthesis of hybrid manipulators. Recently, she initiated platform, **PUNJRobotics**, to assist in uplifting the interdisciplinary field of Robotics, within the institute and around. https://sites.google.com/a/iitrpr.ac.in/physics/

Mode of Registration

STEP – 1: One-time web-registration at GIAN portal (http://www.gian.iitkgp.ac.in/GREGN/index) through a non-refundable payment of Rs. 500/- (one-time).

STEP – 2: Course Registration

The shortlisted candidates will be informed by email. They need to make full payment of the course registration fee.

- **either by NEFT (Account holder name: The Registrar, IIT Ropar; Account no: 30836125653; IFSC Code: SBIN0013181; Bank: SBI; Branch Name: IIT Ropar)**
- **or by sending a demand draft in favour of "Registrar, IIT Ropar" payable at Rupnagar-140001, Punjab before the last date of registration.**

Registration Fees

Industry/Research organization	Academic institutions	Students
Rs 8000	Rs 4000	Rs 1000

Foreign Partcipants: $ 500

The participants will be provided with accommodation on payment basis.

Course Coordinator: Dr Ekta Singla, Assistant Professor, Mechanical Engineering Department, IIT Ropar, Roopnagar – 140001 (PUNJAB) INDIA, www.iitrpr.ac.in, Phone: +91 1881 242160
Email: ekta@iitrpr.ac.in ekta.singla@gmail.com http://www.iitrpr.ac.in/smmee/ekta, http://www.iitrpr.ac.in/mralab.