

IDETC/CIE 2020 Workshops

Workshop 1 (AM): Planar Linkage Synthesis using Pole and Rotation Angle Constraints

Organizers: Ron Zimmerman - ron.zimmerman@magna.com - Magna seating

Sunday August 16th

Recent developments in the 2D sketcher capabilities of modern CAD systems allow the creation of dynamic or moveable constrained geometry. Dynamic geometry is a new tool for the design of planar linkages and provides the opportunity for new synthesis methods. One method exploiting the advantages of this new tool is Pole and Rotation angle Constraints (PRC). It has the intuitive, visual advantages of graphical methods and the fast and accurate advantages of analytical methods. PRC provides a single approach for every planar four-bar linkage synthesis problem that is not over constrained. Since CAD tools are commonplace in academia and industry, there is direct carryover from education to industrial practice. Learn this breakthrough method to solve linkage synthesis problems faster and minimize trial and error since you can easily see thousands of possible solutions. The class will focus on the exact synthesis of four-bar linkages for rigid body guidance, point path generation, function generation and any combination of these tasks.

Workshop 2 (AM): Engineering Optimization and Sustainability

Organizers: Nand Jha - nand.jha@manhattan.edu - Manhattan College

Sunday August 16th

The workshop will introduce sustainability principles and its effects on design and manufacturing and other engineering fields. There is no reference book in which sustainability and optimization principles are linked together. The workshop will be very contemporary and relevant for both academic communities and leaders from industry. It will contain problems from ecology, environment, recycling, reuse, and reconfigurations of engineering theory and practice. Detailed topics pertaining to mathematical tools for sustainability, maximizing recyclability, reuse and attaining a carbon neutral footprint will be covered. Necessary mathematical tools such as optimization, geometric and nonlinear programming will be introduced.

Workshop 3 (AM): Let Us Use Instinct More in Engineering

Organizers: Shuichi Fukuda - shufukuda@gmail.com

Sunday August 16th

Environments and situations come to change frequently and extensively, and these changes become unpredictable. We are thrown in the flow. We need to explore the new way, depending on our own personal capabilities, to swim against the flow and get to our destination. There is no other way than to learn by trial and error. But, how can we? Engineering up to now is largely control-based because changes were smooth so that we could predict the future. But today, tomorrow is another day. No matter what environment and situation come up, we need to win the game. If we look at invertebrates, the octopus is typical. An octopus can survive on instinct alone, without any knowledge. In fact, the octopus dies soon after its offspring are born. Therefore, there is no inheritance of knowledge from the previous generation. Still, the octopus is known as the expert of escape across environments and situations. This is because they interact with the real world directly. Our engineering is knowledge-centered, but to cope with unpredictable changes, we need to move to be wisdom-focused. To achieve this goal, we should pay attention to our instinct and consider how we can utilize it more in engineering to win this challenging game.

Workshop 4 (AM): Modelling for periodic simulation of diurnal cycle in attic space

Organizers: Anuj Gupta & Bhavyanidhi Vyas - anuj.mech.gupta@gmail.com

Sunday August 16th

Attic spaces encounter major heat losses from a building. A large number of studies has been published for the simulation of attics in terms of natural convection. In reality, the conditions of a typical day lead to an initial increase in temperature of the surrounding environment with the rise of sun, and after reaching a peak, temperature starts decreasing. As a result, steady-state attic analysis is not representative of the actual conditions. This workshop presents a methodology for modeling the diurnal cycle using ANSYS Fluent.

Workshop 5 (PM): Navigating Conferences: Successful Collaboration and Co-Authorship

Organizers: Elizabeth Starkey, Nicole Damen, Charlotte de Vries, & Christine Toh - ems413@psu.edu - (Pennsylvania State University & University of Nebraska Omaha)

Sunday August 16th

The workshop is designed to provide graduate students and faculty members from underrepresented groups with professional development activities and to give them the opportunity to make connections with an international network of supportive researchers within the Design Engineering Division (DED) of ASME. In addition to skill development, this workshop will support the development of a network of people within the community from underrepresented groups. As the eleventh annual workshop event of the Broadening Participation Committee of the ASME DED, this workshop focuses on helping attendees choose appropriate co-authors and collaborators in order to develop their own research path. Attendees will learn skills to improve productivity, choose co-authors/collaborators, and manage co-author/collaborator relationships. Attendees will reflect on their individual goals, map out their network of collaborators, and build blueprints for achieving their goals.

Workshop 6 (PM): Motion Design Using a Novel Robot Kit and a Mechanism Design app

Organizers: Anurag Purwar - anurag.purwar@stonybrook.edu - State University of New York at Stony Brook

Sunday August 16th

This workshop will demonstrate a state-of-the-art app called MotionGen for designing and simulating planar linkages and a novel robot kit called SnappyXO for rapid prototyping of the robot motions and structures. The app and robot kit are being used in Freshman Design Innovation, undergraduate and graduate Kinematics classes at Stony Brook University. The SnappyXO robot kit is a low-cost, modular, and innovative kit, which allows structural prototyping of robot chassis and their motions. It works with off-the-shelf electronics, open source software, and employs an open architecture to allow users to design and make their own parts.

Workshop 7 (PM): Design of Smart Cyber-Physical Systems

Organizers: Imre Horváth - i.horvath@tudelft.nl - Delft University of Technology & Yan Wang - yan.wang@me.gatech.edu - Georgia Institute of Technology

Sunday August 16th

This workshop aims to provide a platform for discussions of research issues and design challenges for emerging cyber-physical systems (CPS). It will begin with position statements by the moderators on what generations of cyber-physical systems are, how smartness and intelligence come into the scene, and what

they together mean in everyday system development and applications. Group discussions and collective topic discussions will follow. For example, topics that investigate the contexts, specify what is needed, consider the smart features, put the concept into a real-life situation, evaluate the affordances and the tradeoffs will be discussed. Finally, the moderators will summarize the outcome of the day and identify some critical issues for reconsideration by the audience.

Workshop 8 (PM): Topology Optimization with Geometric Components

Organizers: Julian Norato - julian.norato@uconn.edu - University of Connecticut

Sunday August 16th

Prevalent topology optimization techniques produce organic designs that are highly efficient but often difficult to manufacture. This difficulty arises from the field representations of the structure employed by these methods, which provide great freedom and readily accommodate shape and topological changes but at the same time, make it very difficult to incorporate high-level geometric requirements. To address these shortcomings, several topology optimization methods have been formulated in the last decade to design structures made exclusively of geometric components with high-level parameterizations such as those used in solid modeling systems. These methods can render structures made exclusively of, say, stock material such as bars and plates or B-spline-shaped holes. In this workshop, we will review the main techniques used by these methods, with a particular emphasis on the formulations to map the high-level geometric features onto a fixed finite element mesh for analysis. The workshop will also discuss and demonstrate applications of topology optimization with geometric components. Particular emphasis will be given to the geometry projection method, one of the leading techniques in this family of approaches. Participants will use a freely available geometry projection code to examine the inner workings of the geometry projection method and perform some numerical experiments.

Workshop 9 (PM): Introduction to resilience modeling in fmdtools

Organizers: Daniel Hulse - hulsed@oregonstate.edu - Oregon State University

Sunday August 16th

Many modeling advancements and methodologies have been presented in the literature to improve the resilience of complex engineered systems. However, a lack of publicly-available open-source tools has made it difficult to perform research in this area, since one must either rely on proprietary tools or re-implement methods oneself to apply and/or extend them. The fmdtools Python toolkit solves this problem by providing model-defining classes, fault propagation algorithms, and analysis methods that, when applied together with a user-defined model, constitute an environment for resilient design. This workshop will cover the basics of resilient design in fmdtools, including an overview of supported use-cases; an introduction to the toolkit struct classes and methods; installation; a baseline example of implementing a simple model; and development for ongoing contribution/collaboration.

