Workshop attendance is free to all registered AM3D/IDETC/CIE 2015 participants. As there is limited seating, attendees must pre-register. All workshops and tutorials will be held on Sunday, August 2, 2015, at the Hynes Convention Center (times shown may change). For AM3D attendees, W1 & W8 are focused on Additive Manufacturing but we encourage attendees to take advantage of the other workshops as well.

Tutorials

T1: Robot Limb Virtual Prototyping Design and Control
Organizers/Speakers: Ferdinando Cannella
Time: 1:00pm – 5:00pm
Location: TBD

**Description:** This tutorial shows the fundamental principles and theoretical concepts to design a robotic limb and a control implementation using both the analytical and numerical approach. That permits to the participants to combine and to exploit these two methods to solve the kinematic and dynamic equations of a robot limb. The Multi-Body Dynamics (MBD) numerical method, in fact, is well known in the industrial R&D, but it is not so widespread in the academic environment; therefore this tutorial aims to prove that it could be a useful tool to support also the basic research. For this aim, the demo will help to demonstrate that the numerical results not only will match with the analytical one, but also with the experimental tests. The attendees will experience that the control works both for the virtual and physical model.

Moreover, the participants will be fully trained to design the complete robot limb at their home. During the tutorial, emphasis will be placed on walking participants through the building and validation of the numerical model with the experimental one. Attendees should bring their laptops computers with Matlab installed, since the workshop will combine theoretical explanations with practice on the computer.

T2: Analysis and Synthesis of Compliant Mechanisms
Organizers/Speakers: Haijun Su, Ohio State University
Time: 1:00pm – 5:00pm
Location: TBD

**Description:** Compliant mechanisms transform motion and forces (at least partially) through the deflection of their flexible elements. Compared with traditional kinematic mechanisms, the advantages of compliant mechanisms include no binding (monolithic design), concise design (flexible members serving multiple functions), light (smaller part number), low maintenance (no bearing, no lubrication), and high precision (no backlash, no worn). Compliant mechanisms have
been applied to numerous applications ranging from precision machinery, robotic devices to MEMS sensors and medical devices and so on. Design and analysis of compliant mechanisms remains a challenge due to the knowledge between two fields: kinematics and mechanics.

This tutorial covers recent developments in mathematical methods and computational for analysis and synthesis of compliant mechanisms. The topics include: Nonlinear beam theories such as Euler and Timoshenko beam, general pseudo-rigid-body models, kinetostatic analysis and synthesis, screw theory, compliance matrices, mobility analysis/synthesis. Also a tutorial of a computational compliant mechanism design tool recently developed at the Ohio State University will be given.

T3: Fractional Order Mechanics – An Introduction  
Organizers/Speakers: YangQuan Chen  
Time: 1:00pm – 5:00pm  
Location: TBD  

Description: This workshop is to give an introduction of a new emerging field of study known as “fractional order mechanics (FOMech).” Fractional calculus is about differentiation or integration of noninteger order. Traditional calculus uses integer order differentiation or integration. As mechanics goes into micro and nano world, more and more “anomalous” behaviors are being observed in materials such as porous medias, particulate systems, soft matters etc. The inherent nature of memory, or hereditary, or long range dependence, or long range interactions in the mechanic systems at the smaller scale prompts us to take a look of the modeling tools we are using. It turns out that, using integer order calculus based tools may limit our insight into the mechanical behaviors at all micro, meso, and macro scales. This workshop will focus on introducing “fractional order mechanics (FOMech)” by covering 1) Motivations and real world needs; 2) Mathematical foundations; 3) Fractional mechanics in classical sense (Bagley-Torvik) (3) Fractional Euler Lagrange mechanics; 4) Fractional variational principle.

T4: Parallel Computing on Graphics Processing Unit (GPU) Cards for Applications in Mechanical Engineering  
Organizers/Speakers: Dan Negrut, Radu Serban  
Time: 8:00am-5:00pm  
Location: TBD  

Description: This workshop provides an overview of CUDA-enabled GPU computing followed by a hands-on GPU programming session. The participants will use their laptops to remotely log into a GPU cluster and practice, through concrete hands-on examples, parallel programing in CUDA. The workshop will conclude with a discussion of library support for GPU computing and of SPIKE::GPU, a library for the GPU solution of large sparse linear systems.
T5: Introduction to Non-contact, Full Field Vibration Measurements and Advanced Data Analysis (Invited Tutorial)
Organizers/Speakers: Arend von der Lieth
Time: 1:00pm – 5:00pm
Location: TBD

This workshop is geared towards everyone interested in non-contact vibration data analysis with a focus on full-field vibration measurements. After an introduction to laser Doppler vibrometry and presentation of some typical examples the user will get to experience scanning laser vibrometers in an extensive hands-on session. Participants are welcomed to bring their own test samples if they can be excited easily. The workshop will cover topics relevant to non-contact, full field vibration measurements and advanced data analysis, including:
- Making measurements using a scanning vibrometer
- Basics of Laser Doppler Vibrometry and typical applications
- Data analysis and processing.

W1: How to Make 3D Printing Work for your Company (Invited Workshop)
Organizers/Speakers: Mike Vasquez (3Degrees)
Time: 9:00am-11:30am
Location: TBD

Description: The 3D Printing industry is growing rapidly and there are a lot of options for businesses of all kinds to engage with the technology. This workshop will focus on how companies can best approach, integrate, and expand 3D Printing technologies to meet their business objectives. Several case studies will be presented to give those less familiar with the technology a framework to help them think through the question of how to make 3D Printing work for them.

W2: Developing Ideation Flexibility at Your Institution: Co-Creation of the Ideation TRIO
Organizers/Speakers: Seda Yilmaz
Time: 8:00am-12:00pm
Location: TBD

Description: The aim of the Workshop on Co-Creation of the Ideation TRIO is to provide a diverse set of participants with an understanding of our research and the materials we have developed to support ideation flexibility, as well as a venue in which they can develop specific plans for using these materials in their own classrooms/organizations and develop new materials and activities as well. The intent is for participants to collaborate with the research team in co-creating pedagogical materials for their classrooms (if they are engineering educators) or training materials for their professions (if they are practicing engineers). We aim for participants to return to their institutions / organizations fully prepared and committed to integrating these approaches and materials into their curricula and to collecting student outcomes and case
examples that will be shared with the greater community. Professionals will also benefit from the workshop, as they will have a new set of tools they can use for their own engineering problems in their domains. (www.ideationflexibility.org)

**W3: Emotional Engineering in An age of Material Digitalization**  
*Organizers/Speakers:* Shuichi Fukuda  
*Time:* 1:00pm-5:00pm  
*Location:* TBD

**Description:** Today is called a digital age. But digitalization and discretization are different. Discretization just divides the continuum into elements. But digitalization reformulates our experiences and attach new meanings. Material digitization is expected to provide us with a versatile tool for emotional design just as FEM did for analyzing a continuum of any shape.

**W4: Managing Your Academic Career Like an Entrepreneur**  
*Organizers/Speakers:* Susan Finger  
*Time:* 1:00pm-5:00pm  
*Location:* TBD

**Description:** An academic career spans many years and many roles, accompanied by changes in research interests, technologies, administrators, national priorities, and more. As graduate students, our focus is on research and career paths; as junior faculty, our focus is on research, teaching and service for promotion and tenure; as mid-career and senior faculty, our focus tends to deepen and be driven by a passion whether it be for a research area or an educational goal. For most of us, our careers have been dominated by expectations given in terms of numbers: number of papers, number of research dollars, number of citations, number of PhD students advised and graduated. Stepping back and reflecting on the careers of our colleagues who have had successful and fulfilling careers yes they have had success with numbers - but their focus has been driven by a passion to contribute and their ability to embrace their career very much like an entrepreneur with goals, resources, and constraints. While much of the terminology of business - buying, selling, employing may seem out of place in academia, the underlying idea of heralding resources to fulfill goals is not. This workshop explores the advantages of thinking of an academic career as an enterprise, which requires strategic planning, careful day-to-day management, investment in the future, willingness to collaborate, sales, networking and some risk taking. Participants will learn and share strategies and methods that have been successful.

This workshop will be the seventh annual workshop event of the Broadening Participation Committee of the ASME DED. 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 in their field. In addition to skill development, this workshop will support the development of a network of people within the community from underrepresented groups. This
year’s workshop leader will be Dr. Robert Brown. Dr. Brown is the founding director of the Bioeconomy Institute (BEI) at Iowa State University, a university-wide initiative that coordinates research, educational, and outreach activities related to biobased products and bioenergy. The BEI has helped established several new research enterprises at ISU including the NSF-sponsored Center for Biorenewable Chemicals, the Biobased Industries Center, the Biocentury Research Farm, the Biorenewables Research Laboratory Building, the NSF-sponsored EPRSCoR RII project, and the USDA-sponsored CenUSA Bioenergy project. Dr. Brown has published over 120 refereed papers and is PI or co-PI on over $70 million in cumulative research funding. He is a Fellow of the American Society of Mechanical Engineering, a Distinguished Iowa Scientist of the Iowa Academy of Science, and the recipient of the David R. Boylan Eminent Faculty Award for Research at ISU in 2002. He received an R&D 100 Award from Research and Development Magazine in 1997 and was named one of the “Top 100” researchers in bioenergy by Biofuels Digest in 2011.

W5: Success as a Student Researcher: A Discussion of Best Practices
Organizers/Speakers: Scott Ferguson
Time: 1:00pm-5:00pm
Location: TBD

Description: The objective of this workshop is to create a forum for students attending the IDETC / CIE conferences to learn about and discuss best practice to achieve success as a student researchers. Faculty and Ph.D. students from the design community will present best practices and ways to identify / avoid the common pitfalls that students commonly face. Topics will range from research skills (e.g., how to conduct a literature review, how to develop a research plan) to social skills (how to work with your lab-mates, how to interact with your advisor). Discussion will take place via panels, presentations, and open question periods. It is expected that student attendees will also have opportunities to build cross-university relationships and get excited for the conference.

W6: Introduction to Managing Complex Systems
Organizers/Speakers: Franz-Josef Kahlen
Time: 8:00am-12:00pm
Location: TBD

Description: Engineers and managers are presented with major challenges during the application of engineering content in the presence of often unknown cause-effect chains and networks. Concerns raised by engineers as well as hiring managers always refer to their deficiencies in understanding complexity in systems, how such complexity can be visualized to distributed stakeholders in a project, assessment challenges of the overall performance of a machine, as opposed to the detailed functions of a component, as well as establishing criteria for, and transparency of decision-making. This workshop addresses the above deficiencies from a holistic perspective, accounting for issues in communications, teamwork across discipline and geographic boarders, and project / design status visualization. It is the objective of this workshop
to present an introductory exposure to and awareness of complex systems, the presence and drivers of systems, and generally to create an understanding that organizational health requires strong engineering content, supported by management skills and transparent decision-making cultures.


**Organizers/Speakers:** Karthik Ramani  
**Time:** 1:00pm-5:00pm  
**Location:** TBD

**Description:**  
The advent of novel consumer-level technologies, such as depth cameras, virtual reality (VR), augmented reality (AR), and 3D printing devices, has brought about a disruptive change in the conceptual design process. We have entered a new culture in which potentially everyone can create, share and prototype their ideas in 3D. This has necessitated the amalgamation of computer-aided geometric design (CAGD) and human-computer interactions (HCI). In this workshop, we will present a holistic perspective on design conceptualization by focusing on how to integrate the human element in the geometric modeling process by combining computer vision, ergonomics, and interaction design principles. In particular, we will look at mid-air interactions, immersive interfaces (virtual and augmented reality), and evaluation techniques for geometric design systems.

**W8: America Makes Workforce/Education Roadmapping Session**

**Organizers/Speakers:** Tim Simpson (PSU) / America Makes TBD  
**Time:** 12:40pm-3:30pm  
**Location:** TBD

**Description:**  
This is a special invitation-only session. Session will review the education and training needs for AM workforce development. Lunch will be provided for those attending this session.