TUTORIALS AND WORKSHOPS

Workshop attendance is free to all registered AM3D/IDETC/CIE 2016 participants. As there is limited seating, attendees must pre-register. All workshops and tutorials will be held on Sunday, August 21, 2016, at the Charlotte Convention Center, Ballroom and Meeting Room Level.

TUTORIALS

T1: Bio-inspired Controllable Structural Networks
Organizers/Speakers: Cornel Sultan, Virginia Tech University
Time: 1:00pm-5:00pm
Location: 201A

Description:

The growing need for lightweight, flexible, and adaptive mechanical systems led to increased interest in structural networks which include a large number of cables. This approach to structural design leads to significant reduction in weight as well as increased flexibility because cables are lightweight and flexible. These designs also have a bio-inspired flavor since they mimic the articulated skeletons of living organisms. In these organisms tendons and muscles prestress and control the movement of the skeletal structure, playing the equivalent role of cables, while bones can be assimilated with bars. If membranes are added to these structures, they mimic the skin of living organisms, thus completing the bio-inspired picture. Importantly, recent advances in power electronics, signal processing, control, as well as materials, computational capabilities and system design, enable implementation of modern controllers that can effectively control the behavior of such structural networks. Following these major breakthroughs, this workshop discussed opportunities, key challenges, fundamental principles, and recent advances in prestressable networks analysis, design, and control. Examples and applications are also included.

T2: Vibration Testing and Fatigue Life through 3-Axis Shaker Systems
Organizers/Speakers: Albert Luo, Southern Illinois University; Ranis Ibragimov, Patrick Zweigart, Dynamics Vibration Testing
Time: 1:00am-5:00pm
Location: 201B

Description:

This workshop will talk about the 3-axis shaker systems to simulate the real vibration environment for the parts and elements of operating machines and structures. Through the accelerated vibrations testing, the fatigue lives of parts and elements during the operation and running of machines and structures will be estimated. The history of vibration testing for engineering parts and elements will be reviewed, and the overview of dynamics and mechanism of the real vibration environment generated by the 3-D shaker systems will be presented. The current capability of shaker systems for industry will be presented. How to set up, control and operate 3-axies shaker systems will be presented. How to control testing resonance and PSD files development will be briefly discussed. For onsite training requests from industry and students, participants can directly contract Dynamics Vibration Testing, LLC. Through this workshop, testing engineers from industry can learn (i) how to setup a vibration testing to match the real vibration environment during the operation and running of machines and structures in engineering, and (ii) how to experimentally collect data (e.g., strains, velocities, accelerations) for numerical simulations and design improvements. In addition, this workshop will train graduate students how to set up vibration experiments for

their research and will help undergraduate students to learn how to do vibration testing and senior design.

T3: Value Creation through Intrinsic Experience
Organizers/Speakers: Shuichi Fukuda, Keio University
Time: 8:00am-12:00pm
Location: 201A

Description:

The fact that user experience (UX) is getting wide attention these days demonstrates the value of processes are increasing its importance. Until now, value has been evaluated based on the functions of a product. But with increasing diversification and personalization, customers start to look for new added values. UX is one of them. But the current industry framework is producer-centric, and customers are supposed to be passive consumers. But they are very active and would like to customize their products. Indeed, UX opened our eyes to the importance of process value. But it is extrinsic experience. What customers want is more than that. They would like to get involved in design and manufacturing. In short, they look for Engineering 2.0, where there are no walls between the producer and the customer, just like Web 2.0. As Maslow pointed out, our customers would like to actualize themselves, because that is the highest human need. They would like to have products that meet their intrinsic motivations and provide intrinsic experience. This tutorial provides the overview of such changes with illustrative examples and describes how we can make a step forward toward this direction.

T4: Parallel Computing on Graphics Processing Unit (GPU) Cards for Applications in Mechanical Engineering
Organizers/Speakers: Dan Negrut, Radu Serban, University of Wisconsin
Time: 8:00am–5:00pm
Location: 202B

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.
NOTE: Due to a limit of 56 GPU-cluster accounts there will be a cap on the number of seats available for this workshop. Registration will proceed on a first-come first-served basis.

T5: 3 dof Flexible Robot Virtual Prototyping Design and Control
Organizers/Speakers: Ferdinando Cannella, Mariapaola D'Imperio, Istituto Italiano di Tecnologia; Konrad Juethner, MSC Software; Yanliang Zhang, MathWorks
Time: 8:00am-12:00pm
Location: 201B

Description:

Nowadays often all the robots are design to be as much as possible rigid, because it is supposed the control works without any structure compliance. That is true when the kinematics and dynamics is based on the stiff links that permit to the joints following the

computed trajectories. What happens if (as examples) the requirement is a very lightweight robot or a soft interaction with humans or the robot has to be able to absorb the impact (for instance in falling)? In those cases the links should be elastic and the control begins to be difficult. In this tutorial, the flexibility is introduced into the robot control in order to show how to be taken into account. After a brief analytical approach, the numerical model will be designed and the simulation will be implemented. The analytical and numerical approach will be applied to the theoretical concepts to design a 3dof flexible robot its control. 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.

The models and the experimental test results will be provided by the organizer in order to demonstrate the accuracy of this method. The participant will be fully trained to design the complete 3dof robot at their home. The attendees will experience that the control works both for the virtual with physical model input and results. During the tutorial, emphasis will be placed on building and validation of the numerical model with both the experimental and the analytical ones. Moreover, the participants will be fully trained to complete the design of the robotic arm after the workshop/tutorial. Attendees should bring their laptops computers with Matlab installed, since the workshop will combine theoretical explanations with practice on the computer.

T6: Vibration of Axially-Loaded Structures
Organizers/Speakers: Lawrie Virgin, Duke University
Time: 8:00am-12:00pm
Location: 202A

Description:

Structural dynamics and mechanical vibration occupy a central position in the analysis and design of a wide variety of structural and mechanical systems. The range of application is vast, from earthquake-resistant structures to rotating machinery to vibration isolation, as well as more recent application to MEMS and nano-scale systems. However, despite the ubiquitous nature of axial loading (including thermal and gravitational effects), the interplay of vibration and buckling has received relatively little attention. Axial loading can have a profound effect on the dynamic behavior of slender structures, with aerospace applications of particular importance. This workshop will introduce a variety of analytical/numerical/experimental approaches, and provide the attendees with a concise introduction to the subject.

WORKSHOPS

W1: Abstraction Methods and Applications in Design
Organizers/Speakers: Julie Linsey, Georgia Tech University; Cameron Turner, Clemson University
Time: 9:00am-12:00pm
Location: 204

Description:

Abstraction is a significant tool in the engineering design process, and can be accomplished in multiple ways. These individual abstraction approaches offer different abstractions, and support different abstraction applications. This workshop will focus on several approaches to abstraction, ranging from Functional Modeling, to Bond Graphs, to SysML and offer participants the chance to apply these techniques to sample problems. In addition, this workshop will provide a forum to explore applications of abstraction to the engineering design process and to consider potential research topics related to abstraction in engineering design.

W2: Incremental to Radical Idea Generation: Using Ideation Flexibility Tools to Support Design Success
Organizers/Speakers: Shanna Daly, University of Michigan; Kathryn Jablokow, Penn State University
Time: 1:00pm-5:00pm
Location: 202A

Description:

Ideation is a crucial skill for all engineers; however, generating a diverse set of ideas can be a struggle. One element of ideation diversity is the extent to which a designer has explored ideas that range from incremental to radical within the relevant design space. Challenges in generating ideas across this range are partially due to one's natural cognitive preferences to preserve or modify current paradigms. However, design tools can support engineers in generating ideas across this continuum. This workshop will present and seek feedback from design educators and practitioners on prototypes of three design tools developed from research to support ideation by both student and practicing engineers: 1) the Problem Framing Guide, which provides engineers with a structure for developing problem statements that lead to more incremental and radical ideas; 2) the Incremental to Radical Heuristic Cards, which provide ideation prompts, examples, and directions to incorporate more incremental and more radical changes to their ideas; and 3) the Teaming Profile, which guides team ideation and synthesis of ideas based on awareness of one's own cognitive characteristics and those of one's team members. We will present research that informed the development of these tools, and the tools will be provided to participants for their use in their own courses or design practices. Additionally, we will invite collaborators to further our research on the impact of the tools on design process and outcomes.

W3: Integrating Entrepreneurial Minded Learning into Machine and Systems Design Courses
Organizers/Speakers: Pierre Larochelle, Chiradeep Sen, Florida Institute of Technology
Time: 8:00am-12:00pm
Location: 205

Description:

This Workshop will utilize an active learning pedagogy to facilitate participant's learning how to integrate entrepreneurial minded learning into their undergraduate mechanical engineering courses. Entrepreneurial minded learning (EML) is defined and motivating factors for infusing EML into the engineering curriculum are discussed. Case studies of integrating EML into traditional mechanical engineering machine and systems design courses are presented. Here the focus is on EML is two courses: (1) a 1st year Introduction to Mechanical Engineering course that employs a systems engineering approach to design, and, (2) a 3rd year Mechanism Design Course that utilizes a project based learning pedagogy. Participants are asked to bring with them a course module that they would like to revise and integrate EML into. Participants will leave the Workshop with a revised course module that includes EML content and a personal implementation plan for deploying EML within their courses.

W4: Dimensional Analysis Conceptual Design (DACM) framework: An Approach Supporting Modelling and Simulation of Systems At Early Development Stage Using A Network Based Approach

Organizers/Speakers: Eric Coatanea, Tampere University of Technology; Ricardo Roca, Johns Hopkins University; Tuomas Ritola, Aalto University; Hossein Mokhtarian, Tampere University of Technology
Time: 8:00am-12:00pm
Location: 206AB

Description:

The Dimensional Analysis Conceptual Modeling (DACM) framework presents an approach intended for the modelling, simulation and specification of Reusable Modeling Primitives (RMPs) building on Dimensional Analysis (DA), Bond/Causal Graph (BCG), and Design Structure Matrix/Complexity Management (DSM) formal methods. The RMP-based specification paradigm underlying the DACM Framework promotes rigorous technical specificity and interdependencies of model functionalities which is conducive to effective and efficient model cataloging, discovery, validation, reengineering, and reuse. The DACM framework is an holistic approach supporting the early design phases. The DACM framework logics are captured and enabled in software, providing user-friendly interfaces that support and direct systems engineering conjoint problem-space and solution-space analyses.

The DACM framework can also be used as an innovation approach. The workshop is intended to present the basis of the DACM framework and to exemplify the framework using several case studies highlighting the different facets of the approach. The benefits that the DACM Framework to the M&S community include the following:
- Specification of simulation models in compact DSM matrix,
- A sound technical basis for the M&S community to validate model specifications,
- Generation of RMP's that enable effective, efficient, and meaningful cataloging, discovery, validation, composability, specification of conceptual models across abstraction (e.g., aggregation) levels, and reuse,
- Improved management of the simulation process in general based in RMP configuration management where supplementary simulations or experiments are needed to complete the knowledge about the system,
- Effective framework for the management of intellectual property ownership claims and data rights license provisions,
- Expeditious production of high-level conceptual models instrumental for analysis of alternatives,
- Early identification of conflicts in system design solution.

W5: Workshop on Design Prototyping Methods: Exploration of Tradeoffs and State-of-the-Art
Organizers/Speakers: Bradley Camburn, Blake Perez, Kristin Wood, SUTD-MIT International Design Centre
Time: 1:00pm-5:00pm
Location: 204

Description:

As design cycles become more and more compressed, it is more evident that prototyping is necessary, but at a deeper level how do we choose the methods to implement? This workshop attempts to address this issue and provide a platform for discussion from both industry and academic participants. Research in prototyping seeks to improve the final outcome of design projects. Techniques such as subsystem isolation and testing, or adaptive fidelity simulations help to reduce development spending and total time from concept to functional design. Other methods such as iteration, and parallel concept testing may be employed to improve design outcome. This workshop aims to introduce a selection of these prototyping methods through presentation and interactive hands-on exercises. They are integrated in the framework of a strategic method. The workshop would provide key insights on the state of the art in prototyping methodology. The exercises also provide a concrete experience to highlight the practical tradeoffs between key methods. This experiential comparison will be mapped back to findings from quantitative research in design science. The program would conclude with a roundtable discussion on the future of research in prototyping. We hope to gain participants with experience in both industrial and research experience in design.

W6: Advancing Sustainable Design: Road-mapping and Community Building
Organizers/Speakers: Cassandra Telenko, Georgia Institute of Technology; Sara Behdad, University at Buffalo; Bill Bernstein, National Institute of Standards and Technology
Time: 1:00pm-5:00pm
Location: 205

Description:

The goals of sustainable design are evolving from a more environmentally focused endeavor to one that integrates environment with social and economic foci. With increasing multi- and inter-disciplinary scope, the need for a stronger, collaborative and international research community increases. Researchers engaged or interested in sustainability and sustainable design are encouraged to join in this road-mapping and community building session as we work together to define opportunities for collaborative research and educational initiatives across domains and borders. Participants and facilitators from ASME and the Design Society's Ecodesign special interest group will map current research and future research directions as well as identify best practices. Outcomes will include an evolved research agenda, a set of best practices, national and international collaborations, and initiatives such as the ecodesign tool repository.

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Please take this survey to share your input and help focus the discussion:
http://goo.gl/forms/DHUHa0nkzE

W7: Success as a Student Researcher: Maximizing Your Productivity and Efficiency
Organizers/Speakers: Scott Ferguson, North Carolina State University; Bryony DuPont, Oregon State University
Time: 1:00pm – 5:00pm
Location: 206AB

Description:

The objective of this workshop is to create a forum for students attending the IDETC/CIE conferences to learn about and discuss research practices that maximize productivity and research efficiency. Faculty and Ph.D. students from the design community will present best practices and ways to identify/avoid the common pitfalls that students 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 build research networks). Discussion will take place via presentations and open question/discussion periods. It is expected that student attendees will also have opportunities to build cross-university relationships and ramp up their excitement for the conference.

W8: Writing Strategies and Publication Productivity**
Organizers/Speakers: Meggin McIntosh, Emphasis on Excellence, Inc.
Time: 1:00pm-5:00pm
Location: 209A

You must apply through this survey link and be admitted in order to attend.
https://www.surveymonkey.com/s/ASMEIDETC2016_Broadening_Participation_Workshop_Application

Description:

The goal of the workshop on Writing Strategies and Publication Productivity is to provide a professional development experience and opportunity for community and networking within the Design Engineering Division (DED) of ASME that supports and mentors underrepresented groups. 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 workshop will be the eighth annual workshop event of the Broadening Participation Committee of the ASME DED

- Do you feel **overwhelmed** when you look at your writing projects?
- Is there a **sense of despair** when you think about your commitments and the writing that is only partially done (or is still only in your head?!)

- Have you announced to the Universe that you have **no more room** for opportunities?
- **Can you hear a ticking clock** as you think about deadlines that are coming ever closer?

In this friendly and focused workshop, taught by a professor who now works with academics around the country, you will get clear on what your writing projects are; develop an overall plan that delineates your writing projects for the upcoming academic year and beyond; and know what your next steps are and when you're going to take these steps, without being overwhelmed. You will have hope. You will pick and choose carefully among the opportunities coming your way. You will progress rather than procrastinate on your writing projects. Sound good? Then plan to join us for this practical workshop on Sunday afternoon from 1:00 – 4:00. Introduce yourself to the possibility and practice of being predictably and peacefully productive as an academic writer.

**** Note:** Registration for this workshop is being handled separately from the main conference registration. If you are interested in attending this workshop, please complete the workshop survey via the link above. Even if you register through the IDETC conference website, you are not guaranteed admittance to this workshop.

W9: Design for Additive Manufacturing
Organizers/Speakers: Evan Kuester, Applications Engineer 3D Systems
Time: 8:00am-12:00pm
Location: 209A

Description:

Not all machines and processes in the additive manufacturing were created equal. This workshop will focus on design techniques and work flows related to the different types of technology's available to users. Most a parts can be printed on a variety of machines; however many times the parts will not be acceptable due to the byproducts of each process. It is important to know when to use specific type of additive manufacturing processes, and how to optimize your design and work flows to suit it. Different additive manufacturing process will be presented, and case studies will be shown of parts that have and have not been designed to get the most out of each process.

W10: Topology Optimization for Additive Manufacturing
Organizers/Speakers: Krishnan Suresh, University of Wisconsin, Madison; David Rosen, Georgia Institute of Technology; Darren Henry, Onshape
Time: 1:00pm-5:00pm
Location: 209B

Description:

Topology optimization is emerging as a powerful design technique for additive manufacturing. The objective of this workshop is to expose the audience to cutting-edge topology optimization techniques and additive manufacturing challenges/opportunities. Strategies for posing and solving topology optimization problems will be discussed. Recent developments in integrating topology optimization and additive manufacturing will be addressed. Attendees will then solve design problems using a cloud based topology optimization service (www.cloudtopopt.com). Following this, a few topology optimization cases-studies will be presented. The workshop will conclude with an open design for additive manufacturing challenge.

W11: Workshop: Understanding MBD and MBE: Realizing the Promise of 3D
Organizers/Speakers: Bryan Fischer, MBD360
Time: 8:00am-12:00pm
Location: 209B

Description:

This workshop will present an overview of 3D Model-Based Definition (MBD) in the context of a Model-Based Enterprise (MBE). Topics such as: model-based product definition, model-based process definition, dataset types and structure, dataset classification, applicable standards, gap analysis, derivative data, data quality, business strategies, implementation strategies, best practices, recommendations, and barriers will be discussed. Understanding an organization's current processes and landscape, how to transition to a more fully integrated Model-Based workflow, and implementing MBE will be addressed. Opportunities and challenges, pros and cons, common missteps and missed opportunities in MBD and MBE will also be included.

W12: Simulating Additive Manufacture Processes Workshop
Organizers/Speakers: Jing Bi, Dassault Systèmes SIMULIA
Time: 1:00pm - 5:00pm
Location: 210A

Description:

Additive Manufacturing is used to build models, prototypes, tooling, and produce parts in plastic, metal, ceramic, and composite materials. Its advantages are derived from the additional design freedoms gained that allow novel complex geometries to be realized at little additional manufacturing costs. The success of this process and as many structural designs, requires a thorough understanding of both the thermal and mechanical response of the design during the manufacture process. Temperature-dependent material properties, thermally-induced deformation, and temperature variations all may be important design considerations. In this workshop, we will walk through our layer-wise simulation solution to predict stresses and distortions and how this technology can be used to engineer the Additive Manufacturing process to increase reliability, minimize errors, and optimize process parameters.