

IDETC/CIE 2009 Workshops and Tutorials
Sunday, August 30, 2009
San Diego Convention Center

WS 1: Teraflop Parallel Computing on a Budget: Applications of GPU Computing in Mechanical Engineering
Location: San Diego Convention Center
Date: Sunday, August 30, 2009
Time: 12:30 PM – 5:30 PM
Website: <http://sbel.wisc.edu/GPUworkshop>

Instructor(s): Dan Negrut (negrut@engr.wisc.edu)

Abstract and Benefits:

As the computer microprocessor industry rallies behind a new design paradigm that emphasizes massively parallel architectures, today's computational methods in Mechanical Engineering are gradually becoming obsolete and ill-positioned to answer the ever growing challenges posed by Simulation-Based Engineering. This workshop will present a series of inroads made in the use of GPU computing for speeding up multibody dynamics analysis, finite element applications, bone modeling, mold design, agent-based modeling, and simulation of granular material. Enabling speedups by factors of 10 to 100, the emerging massively parallel commodity hardware ushers in an era where each one of us will have Teraflop level computational speed at our fingertips.

Workshop Outline:

Beyond strictly showcasing research that leverages this hardware, the workshop will walk the participant through the C-for-CUDA programming model (developed and supported by NVIDIA). C-for-CUDA is a gentle C-with-extensions language that simplifies the programming of the 240 parallel Scalar Processors available on today's commodity GPUs. We will also touch on other emerging platforms for programming the CUDA architecture such as the cross-platform OpenCL standard. The workshop is slated to run in the afternoon starting by a set of presentations of GPU enabled research. It will conclude with a two hour tutorial on GPU computing where it is expected that the participants will write their first GPU program executed on their laptop in emulation mode. Details about the workshop and software/hardware requirements for the workshop participants are listed at <http://sbel.wisc.edu/GPUworkshop>.

WS 2: Effective Negotiation Skills
Location: San Diego Convention Center
Date: Sunday, August 30, 2009
Time: 8:00 AM – 4:00 PM

***** Attendance to this workshop is limited and therefore requires approval from the workshop organizers. To request approval, you must complete the following survey via the website link: http://www.surveymonkey.com/s.aspx?sm=PMMCOulmHbt_2bVIbu5XU66Q_3d_3d. Upon review, you will be notified of your status directly, by email from Gloria Wiens (gwiens@ufl.edu).**

Morning Refreshments and boxed lunch will be served during this workshop.

Instructor(s):

Barbara Butterfield, University of Michigan
Susan Finger, Carnegie Melon
Vijay Kumar, University of Pennsylvania
Achille Messac, RPI
Janis Terpenny, Virginia Tech
Deborah Thurston, University of Illinois
Jane Tucker, Duke University
Judy Vance, Iowa State
Gloria Wiens, University of Florida

Abstract and Benefits:

The goal of the workshop on Effective Negotiation Skills is to begin the development of a community within American Society of Mechanical Engineers that supports and mentors researchers from underrepresented groups. The workshop is designed to provide faculty members and graduate students with professional development activities and to give them the opportunity to make connections with an international network of supportive researchers in their field. This workshop will be the inaugural event of the committee on the Broadening Participation committee of the ASME. The goal of the Broadening Participation committee is to develop, implement and oversee new and existing activities aimed at broadening the participation of women and underrepresented minorities in the activities of Design Engineering Division of the American Society of Mechanical Engineers.

Workshop Outline:

Participants will spend ½ of the workshop focused on developing negotiation skills led by Barbara Butterfield (University of Michigan) and Jane Tucker (Duke University), academic professionals who offer this negotiation skills workshop to groups across the country. They are well known for their long term involvement with the COACH workshops for women faculty sponsored by the AIChE and supported by NSF and NIH. The other ½ of the workshop will be led by the organizing committee with a focus on networking activities intended to foster a variety of long-term relationships including: 1) research collaborations, 2) mentoring, and 3) an affinity group built around common interests/concerns associated with the challenges for under-represented groups in the ASME DED community.

WS 3: Fuel Cell Systems: Challenges and Opportunities
Location: San Diego Convention Center
Date: Sunday, August 30, 2009
Time: 1:00 PM – 5:00 PM

Instructor(s):

Mr. Raymond Puffer (puffer@rpi.edu)

Abstract and Benefits:

Heightened awareness of the world's changing energy and environmental challenges opens the door to new ideas and new technologies, including hydrogen fuel cells. For every challenge there is a corresponding opportunity. Fuel cells are by their very nature a very interdisciplinary technology field, requiring collaboration among individuals from many disciplines. Simple in concept, fuel cells can be very complex systems to design, build and operate. They represent one potential piece of the solution puzzle for the world's energy and environmental troubles. This workshop is intended for the non-fuel cell expert, and should be of interest to individuals from a broad range of fields from design to materials, heat transfer, thermal/fluids, materials, manufacturing, and controls. At the conclusion of the workshop the attendees will understand the basics of fuel cells and their uses, and have an appreciation for the issues, challenges and opportunities associated with making fuel cells a technology success.

Workshop Outline:

This 4.5 hour workshop is intended for individuals who are not experts in the field. During the workshop we will cover:

- Fuel cell basics: what they are and how they work;
- Various types of fuel cells and their pros & cons;
- The opportunity, including example applications and current state of the art;
- The National roadmap for the hydrogen economy;
- The challenges, barriers to implementation; and the key issues that must be addressed; and
- Design and manufacturing examples and case studies.

WS 4: Challenging the Triangle: Engineering, Culture and Experience
Location: San Diego Convention Center
Date: Sunday, August 30, 2009
Time: 10:00 AM – 5:00 PM (there will be a 1 hour break for lunch)

Instructor(s):

Prof. Shuichi Fukuda, Stanford University (shufukuda@cdr.stanford.edu)

Abstract and Benefits:

This workshop will explore the possibilities of how the producer and the customer can work together and create new markets with attention paid to culture and experience. Most of our current products are context independent and produced mainly for the producer's benefits. But in the diversifying society today, context dependence, hence, culture and experience, is magnifying its importance. If we consider culture and experience more, we could create more value not only in our products but also in our processes. This will lead us to a new direction in engineering.

Workshop Outline:

(1) Bio-inspired Robotics: Experience, Culture and Design

Mark R. Cutkosky, Stanford University, USA

Bio-inspiration has long been a component of the process of creating novel designs. Famous examples include the designs of Leonardo da Vinci, inspired by his observations of flight and of anatomy. Robot design also draws heavily on biology; indeed the goal of robotics is to create machines that can sense, reason, locomote and operate in the world much as an animal or human does. Recent years have seen a dramatic increase in the number of explicitly bio-inspired robots and devices. In this talk we will explore the reasons behind this trend, which draw upon advances in biology, engineering design, materials science and fabrication. However, success also requires bridging cultural differences between biologists and engineers. These arguments will be illustrated with examples of design collaborations that have produced several bio-inspired robotic systems

(2) Engineering-Culture-Experience: What is in the Locus?

Imre Horvath, Delft University of Technology, the Netherlands

My position statement will put socially and ecologically responsive product design into the locus of the E-C-E triangle and will show that it has a key role in utilizing technological affordances, meeting compelling cultural diversity, and raising pleasant experiences for people. In addition to mentioning the current trends, I would also like to pull the attention to some open issues.

(3) Exploiting Expert Users' Skills and Dexterities in Engineering

Monica Bordegoni, Politecnico de Milano, Italy

The conception of products with aesthetic value is still carried out using digital tools that are technical and do not exploit users' skills, dexterities and creativity. It is the time now to change the paradigm at the basis of the design tools, which should understand and react to users' emotions and support multi-sensory interaction with the digital products. In addition, not only the designers but also the final users and the customers of the designed products should be the users of these tools.

(4) The Background of Prius Development

Shoichi Sasaki, Keio University, Japan

The background of world first commercial hybrid passenger car, Prius, is introduced with the history of environmentally friendly vehicle development in Toyota, from the technical and management point of view.

Technology of secondary battery, power switching device

(Insulated bipolar transistor), vector control of AC motor, rare earth magnet, and simulation tech. for hybrid system are the key for the realization of Prius. Also the top management and development culture in Toyota are important factor.

(5) The Creative Customer

Shuichi Fukuda, Stanford University, USA and Open University of Japan

Creativity is attracting wide attention in engineering. But most of these arguments focus their attention to the producer alone. But as software development changed from fixed function to evolving function, how we can validate the expectations of the customer by satisfying their desire for creativity and for customization becomes more and more important in terms of creating life time values. Such topics as value co-creation, creative maintenance, emotional attachment, etc will be discussed.

WS 5: Formal Modeling in Systems Design
Location: San Diego Convention Center
Date: Sunday, August 30, 2009
Time: 1:00 PM – 5:00 PM

Instructor(s):

Dr. Olof Johansson (Linköping University, Sweden),
Dr. Stephan Rudolph (University of Stuttgart),
Dr. Kristina Shea (Technical University Munich),
Dr. Russell Peak (Georgia Institute of Technology).

Abstract and Benefits:

Over the last decade, the development of many types of products has evolved into a systems integration problem. Large numbers of sub-systems are integrated to achieve unparalleled functionality and reliability at an ever decreasing cost. To continue this trend, there is a need for computer-based support that allows the knowledge and expertise of many domain experts to be shared, managed, and applied towards the thorough exploration of different system architectures while considering complex trade-offs between multiple objectives under uncertainty. Supporting this complex endeavor is the focus of Model-Based Systems Development. Recently, several formal languages have been proposed to support Model-Based Engineering (e.g., SysML, STEP AP 233) and a variety of tools have become available to support these languages. Still, there remain many open issues as to how one best uses the languages and tools to support the design process. In this workshop, an overview will be provided of recent advances and open questions in the area of Model-Based Systems Design.

Workshop Outline:

There will be four speakers who will address specific questions related to Model-Based Systems Engineering. Each presentation will be followed by a 15-minute discussion period. At the end of the workshop, all speakers will participate in an open panel discussion.

Specifically, the speakers will address the following questions:

- How to capture and re-use system-level design knowledge?
- What is the role of graphs and graph transformations in systems design?
- How to predict the performance, cost, reliability of systems effectively?
- Should we aim to “Model Everything” — requirements, functions, structure, behavior; but also meta-information about models, methods for applying models, design patterns, etc.?
- What are relevant modeling formalisms for supporting systems design?
- How can system complexity be managed in a Model-Based Engineering framework?