



MSEC Symposium Invited Speaker Program

Monday, June 5th: 11 Am - 12:30 Pm ; RTCC Ball Room

MSEC Session: 8-3-2 Big Data Implications for Manufacturing & Design Innovation

Title – “A New Kind of Thinking: Revolutionizing Design and Manufacturing”

Speaker: Dr. William C. Regli, Acting Director of the Defense Sciences Office, Defense Advanced Research Projects Agency (DARPA).

Abstract: The revolution underway in manufacturing is the product of a diverse set of disciplines that have reached a level of maturity to offer radically new tools and capabilities. Because of these simultaneous advances in materials science, process control, robotics---and especially computation, data and machine intelligence---we can begin to envision design and production as an information-centric and algorithmic process. Somewhat surprisingly, however, many of our most advanced approaches to design and fabrication remain firmly grounded in methodologies and processes that literally go back centuries.

As we enter this era of computation, data and machine intelligence, we are offered the opportunity to reframe, tabula rasa, the system of design and production. We will discuss the need (and opportunities) for a paradigm shift in design and manufacturing and provide several examples of what the new scientific questions might be like. Ultimately, for each of these questions, the challenge is how to integrate human creativity and insight with computing machinery in order to have the machines not just as our tools---but as our partners.

Biosketch:

Dr. William Regli became the Acting Director of the Defense Sciences Office (DSO) in January 2017. For the past two years, Dr. William Regli was the Deputy Director of DSO. Dr. Regli is a computer scientist with a passion for addressing interdisciplinary and use-inspired problems using knowledge representation, physics-based modeling and other computational techniques. His most recent activities have focused on deploying cyber-infrastructure systems to capture and curate engineering and science data, and ensure the long-term sustainability of data. Dr. Regli's current interests include computational tools to exploit the properties of advanced materials, additive manufacturing systems and enabling new paradigms for design and production.



Dr. Regli has published more than 250 technical articles, including those in leading venues for research in computer graphics, artificial intelligence, robotics, wireless networking, tissue engineering, and engineering design and manufacturing. His research has spawned two start-up technology companies (one focused on mobile communications for public safety, the other on information management in edge networks) and resulted in five U.S. Patents. He is a Fellow of the Computer Society of the Institute of Electrical and Electronics Engineers (IEEE) and a senior member of both the Association of Computing Machinery (ACM) and Association for the Advancement of Artificial Intelligence (AAAI).



MSEC Symposium Invited Speaker Program

Tuesday, June 6th: 11 Am - 12:30 Pm ; **RTCC Ball Room**

MSEC Session: 8-3-1 Additive Manufacturing

Title – “*The Development and Prospects for Additive Manufacturing*”

Speaker: Dr. David L. Bourell, Temple Foundation Professor, Mechanical Engineering Department, The University of Texas at Austin.

Abstract: Modern Additive Manufacturing (AM) is proposed to have begun in 1988 with the first transfer of a commercial AM machine, the SLA-1 by 3D Systems. However, the concept of layered additive manufacturing significantly predates the computer. The author divides developments in AM into three historical categories with illustrations that draw from US patents. Earliest is *AM prehistory*, dating back almost 150 years and associated with the period before the advent of computers. Second are *AM precursors*. Covering the period from about 1960 to 1984, these inventions embodied all the salient aspects of modern AM, but none were commercialized. It is speculated that a contributing factor was the limited knowledge and general utilization difficulty of modern distributed computing. Finally, *modern AM* exploded onto the commercial sector starting in the mid-1980s with most current processes being invented in a ~10-year period from 1985-1995. The presentation will close with a brief analysis of recent developments, a future outlook and identification of some current challenges to advancement of AM technologies.

Biosketch:

Dr. David L. Bourell is the Temple Foundation Professor of Mechanical Engineering at The University of Texas at Austin. He is currently Director of the Laboratory for Freeform Fabrication. Dr. Bourell's areas of research include particulate processing with emphasis on sintering kinetics and densification, and materials issues associated with Laser Sintering (LS). Professor Bourell is a leading expert in advanced materials for Laser Sintering, having worked in this area since 1988.

Dave was the lead author on the original materials patent for LS technology. Issuing in 1990, this patent has been cited by over 190 other patents, and it represents the original intellectual property for mixed and coated powders for LS, including binders. Since 1995, he has chaired the organizing committee for the Annual International Solid Freeform Fabrication Symposium – An Additive Manufacturing Conference. This meeting is a leading research conference on additive manufacturing. He holds 9 primary patents dealing with materials innovations in LS dating back to 1990 and has published over 200 papers in journals, conference proceedings and book chapters. Dr. Bourell is a Fellow of ASM International and TMS, and he is also a lifetime member of TMS. He was elected an Associate Member of the CIRP in 2013. In 2009, he received the TMS Materials Processing and Manufacturing Division Distinguished Scientist/Engineer Award. He has received two major conference career awards in additive manufacturing: the SFF Symposium FAME Award and the Portuguese VRAP Career Educator Award. He is also the 2017 recipient of the SME Albert Sargent Award for “significant accomplishments in the field of manufacturing processes, methods or systems”.





MSEC Symposium Invited Speaker Program

Tuesday, June 6th: 3:45 – 5:15 Pm ; **RTCC Ball Room**

MSEC Session: 8-3-3 Nanotribology Implications for Manufacturing

Title- *“Emerging Trends in Nanotribology, and their Implications for Manufacturing”*

Speaker: Dr. Robert W. Carpick, John Henry Towne Professor and Department Chair, Mechanical Engineering & Applied Mechanics, University of Pennsylvania.

Abstract: Advanced manufacturing methods are continually progressing to smaller scales in multiple ways, including manufactured component feature size, finished surface roughness, and desired dimensional accuracy. At small length scales, the high surface-to-volume ratio ensures that surface interactions such as friction, adhesion, and wear, become critically important in controlling the manufacturing process, and must also be accounted for in designing small-scale devices that will function properly. Unfortunately, a lack of fundamental understanding of such tribological interactions has prevented the rational design of small-scale manufacturing processes. In this talk, I will review challenges and opportunities in micro- and nano-manufacturing, and will highlight tribology problems and the solutions that exist for addressing them which have been developed through basic research in tribology. Examples will include: the successful development of nanocrystalline diamond tool coatings to enable the dry micro-milling of aluminum; the development of nanostructured diamond atomic force microscope probes for tip-based nanomanufacturing; new insights into the fundamental origins of wear at the nanoscale enabled by *in situ* electron microscopy studies of contact, sliding, and wear; and a novel, early-stage nanoscale additive manufacturing process we call “nanotribological printing”.

Biosketch:

Robert Carpick is John Henry Towne Professor, Dept. of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, where he has served as Department Chair since 2011. Previously, he was a faculty member at the University of Wisconsin-Madison (2000-2007). He received his B.Sc. from the University of Toronto (1991), and his Ph.D. from the University of California at Berkeley (1997), both in Physics, and was a postdoc at Sandia National Laboratory (1998-1999). He studies nanotribology, nanomechanics, and scanning probes. He is the recipient of a NSF CAREER award (2001), the ASEE Outstanding New Mechanics Educator award (2003), the ASME Newkirk award (2009), an R&D 100 Award (2009), and is a Fellow of the American Physical Society, the AVS, the Materials Research Society, and the Society of Tribologists and Lubrication Engineers. He holds 5 patents and has authored over 150 peer-reviewed journal publications.

