

# EPSTEIN INSTITUTE SEMINAR ■ ISE 651

## Design Challenges & Research Opportunities in Additive Manufacturing: Perspectives from an Additive Manufacturing Demonstration Facility

**ABSTRACT** – Additive manufacturing may be as disruptive to manufacturing as the Industrial Revolution was over a hundred years ago. Additive manufacturing frees us from many of our design constraints and provides the capability to produce novel and intricate geometries never before possible. The opportunities that this is creating in fields ranging from aerospace and energy to medical and oil and gas is unprecedented, but there are real obstacles that must be overcome. The potential for warping, cracking, and distortion necessitates a careful understanding of the underlying physics occurring during additive manufacturing of metallic components. When 3D printing metal parts, additive manufacturing is as much about producing a finished part as it is about making a material given the impact that powder properties and processing parameters can have on the final microstructure and resulting material properties. In this talk, I will discuss the design challenges and research opportunities in additive manufacturing and summarize the activities in Penn State's Center for Innovative Materials Processing through Direct Digital Deposition (CIMP-3D), which serves as the DARPA Open Manufacturing Program's Additive Manufacturing Demonstration Facility (MDF). CIMP-3D seeks to (1) advance enabling technologies required to successfully implement AM technology for critical components and structures, (2) provide technical assistance to industry through selection, demonstration, and validation of AM technology as an "honest broker", and (3) promote the potential of AM technology through training, education, and dissemination of information. CIMP-3D also provides Penn State's interface to America Makes, the National Additive Manufacturing Innovation Institute (NAMII), which is charged with transitioning additive manufacturing technology to the mainstream U.S. manufacturing sector and enabling significant advancements throughout industry.



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**SPEAKER BIO** – Dr. Timothy W. Simpson is a Professor of Mechanical & Industrial Engineering at Penn State University with affiliations in Engineering Design, Information Sciences & Technology, and Architecture. He is also the co-Director of CIMP-3D ([www.cimp-3d.org](http://www.cimp-3d.org)). He has been PI or Co-PI on over \$30M in funding for his research in product family and product platform design, multidisciplinary design optimization, and additive manufacturing and 3D printing, and he has published over 250 peer-reviewed papers and 2 edited books. He teaches courses on Mechanical Design, Industrial Systems Design, Concurrent Engineering, Product Family Design, and Additive Manufacturing. He is a recipient of the ASME Ben C. Sparks Award, the ASEE Fred Merryfield Design Award, and a NSF Career Award. He has received several awards for outstanding research and teaching at Penn State, including the 2007 Penn State President's Award for Excellence in Academic Integration. He is a Fellow in ASME and an Associate Fellow in AIAA. He currently serves on the ASME Design, Manufacturing, and Materials Segment Leadership Team and is Chair of the ASME Design Engineering Division (DED) Executive Committee. He helped ASME launch the Innovative Additive Manufacturing 3D (IAM3D) Design Challenge in 2014 and served as Chair of the Executive Advisory Committee for the 2015 and 2016 ASME *Additive Manufacturing and 3D Printing Conference*. He received his Ph.D. and M.S. degrees in Mechanical Engineering from Georgia Tech and his B.S. in Mechanical Engineering from Cornell.

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**TUESDAY, JANUARY 10, 2017**

**3:30PM – 4:50PM**

USC ANDRUS GERONTOLOGY CENTER (GER), Room 206