



University at Buffalo

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Design for Additive Manufacturing: Challenges & Research Opportunities

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Abstract: Additive manufacturing provides engineers with unprecedented design and material freedom. Enabled by additive manufacturing (AM) technology, engineers can consolidate assemblies into a single integrated component, lightweight parts using topology optimization and lattice structures, and functionally-graded structures and components made from multiple materials. While many advocate that “complexity is free” when it comes to AM, understanding the design, material, and process limitations associated with AM is important when producing end-use parts. This talk will discuss the challenges associated with part substitution, consolidation, and optimization for AM, with an emphasis on laser-based powder bed fusion systems. Several examples will be used to illustrate the challenges associated with design workflow, support structures, and post-processing. These examples are drawn from 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’s mission is three-fold: (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, outreach, and dissemination of information. CIMP-3D also provides Penn State’s interface to America Makes, the National Additive Manufacturing Innovation Institute (NAMII). Efforts to educate the next generation workforce and (re)train the current workforce to use AM effectively will also be presented.

Bio Sketch:



Dr. Simpson is the Paul Morrow Professor of Engineering Design and Manufacturing at Penn State with affiliate appointments in Architecture and Information Sciences & Technology. He also serves as co-Director of CIMP-3D (www.cimp-3d.org) and helps manage an AM research portfolio exceeding \$8M/year. Dr. Simpson has been PI or Co-PI on >\$30M in funding for his own research in additive manufacturing and 3D printing, product family and product platform design, and design innovation and entrepreneurship. He has published over 300 peer-reviewed papers and 2 edited textbooks, and is currently co-authoring a new textbook on *Design for Additive Manufacturing*. **Awards:** ASME Ben C. Sparks Award; ASEE Fred Merryfield Design Award; SAE Ralph R. Teetor Award; the NSF Career Award; outstanding research and teaching at Penn State, including the 2007 Penn State President’s Award for Excellence in Academic Integration. Dr. Simpson is a Fellow in ASME and an Associate Fellow in AIAA and chaired the ASME Design Engineering Division (DED) Executive Committee and now chairs the ASME Design, Manufacturing, and Materials Segment Leadership Team. He helped ASME launch the Innovative Additive Manufacturing 3D (IAM3D) Design Challenge in 2014 and the 2015 and 2016 ASME *Additive Manufacturing and 3D Printing Conference & Expo*. Dr. Simpson received his Ph.D. and M.S. degrees in Mechanical Engineering from Georgia Tech and his B.S. in Mechanical Engineering from Cornell. *Please contact Prof. Kemper Lewis at kelewis@buffalo.edu if you are interested to meet the speaker.*

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3:30-4:30 pm • 101 Davis Hall

