2017 New Faculty Research Seminar Series
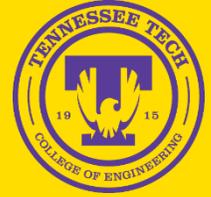
Design for Additive Manufacturing: Towards Direct Digital Manufacturing

Presented by Yunbo (Will) Zhang, Ph.D.

Abstract: Additive manufacturing (AM) is a promising technique for fabricating 3-D objects with complex shapes and custom materials, which are difficult to be fabricated by the traditional manufacturing processes. Since the AM technology is initiated in early 1980s, it is evolving from rapid prototyping to Direct Digital Manufacturing (DDM), which manufactures end-use products directly from a digital model without intervening tooling. DDM can be realized by integrating advanced manufacturing process and new design methods. Currently, there are still many challenging problems existing in the Design for Additive Manufacturing (DfAM) research, which prevent AM from producing end-use products. This talk will present my research on a series of design methods and geometric modeling algorithms to tackle some of the challenges in DfAM, including designing products with freeform shapes and embedding multi-functional components in AM process. AM techniques enable the manufacturing of 3-D objects with complex freeform shapes. As traditional CAD systems adopt parametric surfaces to represent 3-D shapes, it is difficult for them to design products with freeform shapes. To fill the gap between current CAD software and the demands of designing freeform products, a novel computational design framework was developed to enable users to design additive manufacturable freeform products. To complement the functionality of the printed products, a new AM system for embedding functional components during the process was also studied. Multiple degree-of-freedom (DOF) and multi-process were introduced into existing AM process, which enabled functional components embedding and more flexible toolpath planning. The new opportunities brought by newly added DOF were explored, such as support material reduction and non-planar layer printing. In this talk, both the design methods and the manufacturing process will be presented. Some related topics in DfAM and its applications in mechanical and biomedical engineering will also be covered.

About the Speaker: Yunbo "Will" Zhang is currently an assistant professor in Department of Mechanical Engineering at Tennessee Tech University. He received his Ph.D. from the Department of Mechanical and Automation Engineering at The Chinese University of Hong Kong. His research interests include design for additive manufacturing, computer-aided design and manufacturing, human-centered design and manufacturing, and geometric and solid modeling. He has published 11 journal papers and eight conference papers. His survey paper about additive manufacturing has become the most downloaded paper in the last 90 days on the Journal of Computer-aided Design (JCAD). Zhang received a few awards from professional societies and industries including Best Lifestyle Bronze Award from Hong Kong ITC Awards in 2008, Championship of Vice-Chancellor's Cup of Student Innovation from CUHK in 2009, and Purdue Postdoc Travel Grant 2016-2017. He is a member of The American Society of Mechanical Engineers (ASME) and Institute of Electrical and Electronics Engineers (IEEE), and he is actively serving on the judging and reviewing panels of conferences and journals. He also worked as a guest editor for the journal of Computer-Aided Design and Applications on a special issue of "Technologies for Human Centric Free-form Products of Computer-Aided Design and Applications".

Tuesday, Oct. 3, 2017, 4:30 to 5:30 p.m.
Prescott 225

For more information, visit
www.tntech.edu/engineering/research or contact
engineering@tntech.edu or call (931) 327-3172.