DREXEL UNIVERSITY
Mechanical Engineering and Mechanics

# MEM WINTER SEMINAR SERIES

## January 31st 11:00 AM

**Hill Conference Room, LeBow Engineering Center, Room 240**

Contact: *A. Najafi*
*arn55@drexel.edu*
*(215) 571-4578*

***Pizza and Refreshments Served***

# TOPOLOGY OPTIMIZATION FOR DESIGNING FUNCTIONALLY-GRADED LATTICE INFILL AND SUPPORT STRUCTURE FOR LASER POWDER BED ADDITIVE MANUFACTURING

***Professor Albert C. To***
University of Pittsburgh

**Abstract**

This seminar will discuss several topology optimization methods recently developed for designing functionally-graded lattice infill, support structure, and build orientation for laser powder bed additive manufacturing (AM), in order to address various manufacturability and residual stress/distortion issues. First, we will present an efficient homogenization-based topology optimization method for optimizing the design of functionally-graded lattice infills in AM components for weight savings and performance enhancement. The motivation for developing this method is to overcome the inability of conventional topology optimization method to eliminate overhangs that are not self-supporting in AM. The proposed method takes advantage of the self-supporting nature of lattice structures, as well as the tunable thermal and mechanical properties of lattices by varying their strut size.

Next, we will discuss a support structure design optimization method proposed to reduce residual stress and distortion in an AM build. The key novelty of this method lies in the formulation of the modified inherent strain model which enables fast and accurate prediction of part-scale residual stress and deformation resulting from laser processing. The proposed model reduces simulation time to a matter of minutes from hours/days using other existing methods and thus makes it practical to use topology optimization for AM support structure design.

**Biography**

Dr. Albert To is currently Associate Professor & CNG Faculty Fellow in the Department of Mechanical Engineering and Materials Science at University of Pittsburgh, where he also serves as the Director of the ANSYS Additive Manufacturing Research Laboratory. He is also the Founding Director of the MOST-AM Consortium, which is a public-private partnership of 25 organizations formed to address the most pressing needs in modeling and simulation for additive manufacturing. Dr. To received his B.S. degree from University of California, Berkeley (U.C. Berkeley) and M.S. degree from Massachusetts Institute of Technology. He obtained his Ph.D. from U.C. Berkeley in 2005 and conducted postdoctoral research at Northwestern University from 2005-2008. He joined University of Pittsburgh as Assistant Professor in 2008 and was promoted to Associate Professor in 2014. His current research interests lie in design optimization and fast process modeling for metal additive manufacturing. He has been a recipient of the NSF BRIGE Award in 2009, the Board of Visitors Faculty Award from the School of Engineering in 2016, and the Carnegie Science Award in the Advanced Manufacturing and Materials Category in 2018.