

# The 17th JUACEP Seminar

第 17 回 名古屋大学日米協働教育プログラムセミナー

## “Additive Manufacturing of Custom Orthoses and Clinical Simulators”

Lecturer: **Professor Albert J. Shih**

**Mechanical Engineering, College of Engineering  
University of Michigan**

### ABSTRACT:

Additive manufacturing (AM) is an enabling technology that can transform the fabrication and enable new innovations. In this talk, custom orthoses and clinical simulators are two examples to demonstrate the potential societal impacts of AM. Foot orthosis (FO) and ankle-foot orthosis (AFO) are the two most common types of orthoses. AM is ideal for personalized products such as custom orthoses, which provide better comfort and function than pre-fabricated ones for users. The fabrication time and material cost for AM are critical to provide advantages over the conventional methods for fabrication of rigid FO and AFO. In this study, the FO and AFO are designed with the sparse structure and topology optimization to enable rapid fabrication and reduce material cost and weight using the fuse deposition modeling (FDM). The optimum design can reduce the volume of FO by 32% and AFO by 26%. This study demonstrates the benefits and potential of FDM for custom orthoses and the need to study wear properties for practical use. On the second example, the anatomically and physiologically accurate clinical simulators for training physicians on medical procedures are critical to patient safety. The 3D shape of organs, vascular, and bone structure based on computed tomography (CT) and magnetic resonance imaging (MRI) data is the foundation for design and AM of the simulator. Silicone, PVC, and gellan gum based phantom materials with the desired optical, mechanical (hardness), sonographic, bioimpedance and needle resistive properties are formulated to mimic the soft tissue for simulators. Examples of the three neurosurgical simulators will be presented to demonstrate the concept and potential impacts to medical education.

### BIOGRAPHY:

Albert Shih, Professor, Mechanical Engineering, Biomedical Engineering, Director of Global Automotive and Manufacturing Engineering, Associate Chair of the Integrative Systems and Design, University of Michigan at Ann Arbor. After received his PhD degree at Purdue Univ. in 1991, Dr. Shih worked at Cummins Inc. at Columbus, Indiana as a manufacturing engineer to develop advanced machining process for a wide variety of diesel engine and fuel systems. From 1998 to 2002, he was Associate Professor in the Department of Mechanical and Aerospace Engineering, North Carolina State University. He joined University of Michigan (UM) in 2003. Dr. Shih's research and teaching interests are in design and manufacturing. Currently, Professor Shih's research and teaching focus are in biomedical design and manufacturing. He works closely with collaborators in the Medical School and Health Systems. Professor Shih is the Fellow of ASME and SME.

**Date: May 20, 2014 13:00~14:30**

**Venue: ES032, ES Building**

**\* 事前参加申込み不要**

**Inquiry: JUACEP Office, Eng. (Ext. 2799)  
問合せ: 世界展開力強化事業事務局 (内 2799)**