Invited Lecture

Improving Additive Manufacturing with Robots and Artificial Intelligence

3:00pm on September 19, 2022 (Mon) Department Seminar Hall

Satyandra K. Gupta

Smith Int'l Professor of Mech. Engg. and Computer Sc.
Director, Center for Advanced Manufacturing
Associate Chair, Aerospace and Mech. Engg. Department
Viterbi School of Engg., University of Southern California

Biography of the Speaker:

Dr. Satyandra K. Gupta's research interests are physics-informed artificial intelligence, computational foundations for decision making, and human-centered automation. He works on applications related to Computer-Aided Design, Manufacturing Automation, and Robotics. He has published more than four hundred technical articles in journals, conference proceedings, and edited books. He is a fellow of ASME, IEEE, SMA, and SME. He has served as the editor-in-chief of the *ASME Journal of Computing and Information Science in Engineering*. Dr. Gupta has received numerous honors and awards for his scholarly contributions. He was named "The 20 most influential professors in smart manufacturing" by Smart Manufacturing Magazine in June 2020. He was given Use-Inspired Research Award by Viterbi School of Engineering in 2021 for creating solutions that are addressing US aerospace and defense industry's needs in the advanced manufacturing area. He has also received ten best paper awards at international conferences.

Abstract of the Talk:

Additive Manufacturing (AM) is expected to revolutionize manufacturing. The current generation of AM technology has overcome many limitations of traditional manufacturing. However, the current AM technology still needs many improvements. This presentation will describe how robots can be used to realize the next generation of AM technologies. The first part of this presentation will describe how performing material deposition using articulated robot arms can significantly expand AM processes capabilities by enabling material deposition on non-planar surfaces. Many composite parts have thin three-dimensional shell structures. Achieving the right fiber orientation is critical to the functioning of these parts. Printing them using conventional planar-layer AM processes leads to fibers being oriented in the plane of the layer. The capability to deposit the material using non-planar conformal layers can produce parts with improved material properties. Robots can be used to perform multi-resolution printing that finds the best trade-off between build speed and surface finish. Robots can also be used to realize of supportless AM. In the near foreseeable future, AM is not expected to produce high-quality electronics (e.g., processor, sensors). The use of robots also enables the insertion of externally fabricated components such as sensors, actuators, and energy harvesting devices during the AM process. The second part of this presentation will describe artificial intelligence techniques needed for generating and executing robot trajectories to build high quality parts using AM.

Hosts: K.P. Karunakaran & B. Ravi