Automating spatial reasoning for design and manufacturing

Dr. Saigopal Nelaturi
Palo Alto Research Center, Palo Alto, California

Abstract: Several spatial reasoning problems in design and manufacturing may be formulated and solved using concepts from signal and image processing. The apparently unrelated domains are bridged by observing that: 1. Spatial reasoning applications are often driven by interference constraints on shapes in relative (rigid) motion; 2. The operations used to characterize these constraints in the ‘configuration space’ of rigid motions directly correspond to well known signal processing operations. The basic ideas of the configuration space formulation and the relationship of interference characterization in configuration space to signal processing will be discussed in this talk. It will be shown that reasoning in the configuration space provides compact formulations of problems in packaging, collision-free motion planning, process planning for machining and additive manufacturing, and design for manufacturability. A couple of manufacturing process planners that have been built at PARC based on this approach will also be demonstrated.

Biographical Sketch: Dr. Saigopal Nelaturi’s research includes intelligent automation, digital manufacturing, geometric modeling, computational design, robotics, and spatial computing. He is the Associate Director for the Design and Digital Manufacturing Program at the Palo Alto Research Center (PARC) where he helps in research, technology development, strategy, and commercialization efforts for PARC’s software solutions in digital manufacturing. He was recently recognized by DARPA as an early career scientist representing the next generation of extreme innovators. Dr. Nelaturi earned his Ph.D. and M.S. degrees in Mechanical Engineering from the University of Wisconsin-Madison, an M.Sc. in Manufacturing from the University of Bath in the U.K., and a B.E. in Mechanical Engineering from the R.V. College of Engineering in Bangalore, India.

For additional information, please contact Prof. Xinyu Zhao at (860) 486-0241, xinyuz@engr.uconn.edu or Laurie Hockla at (860) 486-2189, hockla@engr.uconn.edu