Concurrent Optical Manipulation of a Large Number of Objects

Ashis G. Banerjee
Department of Industrial & Systems Engineering and Department of Mechanical Engineering
University of Washington, Seattle

Abstract

Optical tweezers provide precise multiplexing capabilities at the micro scale with independent control of tens of objects in three dimensions using a dynamically reconfigurable hologram. However, much of its use has been limited to concurrent manipulation of just a few objects for biophysical studies or directed assembly of simple structures using manual or tele-operated control. In this talk, I will present some recent advances in developing real-time perception, planning, and control methods for automated patterning of microstructures comprising colloidal particles or cells. Experiments with silica and polystyrene beads of varying sizes and human endothelial cells in a variety of fluid media show promising performances. The patterned microstructures are expected to form the building blocks of engineered tissues or granular media with enhanced functional characteristics.

Biography

Ashis G. Banerjee is an Assistant Professor with joint appointment in the Department of Industrial & Systems Engineering and the Department of Mechanical Engineering at the University of Washington, Seattle. Prior to his current appointment, he was a Research Scientist in the Complex Systems Engineering Laboratory at General Electric Global Research (GEGR). Before joining GEGR, he was a Research Scientist and Postdoctoral Associate at Massachusetts Institute of Technology. He obtained his Ph.D. and M.S. in Mechanical Engineering from the University of Maryland, College Park, and B.Tech. in Manufacturing Science and Engineering from the Indian Institute of Technology, Kharagpur.

Dr. Banerjee has received several honors including the 2018 Top Engineer of the Year Award from the International Association of Top Professionals, the 2012 Most Cited Paper Award from the Computer-Aided Design journal, the 2009 Best Dissertation Award from the Department of Mechanical Engineering, and the 2009 George Harhalakis Outstanding Systems Engineering Graduate Student Award from the Institute for Systems Research at the University of Maryland. His research interests include cyber physical systems, micro-bio robotics, autonomous mobile multi-robot systems, statistical learning, and smart manufacturing.