



## MMAE SEMINAR

Wednesday, April 11, 2007  
E-1 BUILDING – CRAWFORD AUDITORIUM  
3:30 – 4:30 PM

### Towards Automated Micro and Nanoscale Assembly Using Optical Tweezers

Satyandra K. Gupta  
University of Maryland  
e-mail: [skgupta@eng.umd.edu](mailto:skgupta@eng.umd.edu)



#### Abstract

Optical tweezers can trap and move a variety of microscale and nanoscale components without physical contact and hence without damaging components due to stiction or deformation caused by contact forces. At the same time, optical tweezers provide a broad range of positioning and orienting capabilities to place components at the desired locations in the workspace. By utilizing multiple trapping beams, multiple operations can be performed in parallel. Hence, optical tweezers has emerged as a unique tool for micro and nanomanipulation. In an optical tweezers-based assembly cell, components are usually suspended in a fluidic medium and undergo constant random Brownian motion. Automated assembly using optical tweezers requires online monitoring of components in the assembly workspace and path planning abilities.

This seminar will cover the following two topics. First, we will describe algorithms for estimating locations and orientations of components in the assembly cell using optical section microscopy. Second, we will describe planning algorithms for transporting a component from one location to other in the assembly cell. The planning algorithm moves the components through the workspace while avoiding collision with the other components in the workspace. We expect that the work described in this seminar will provide the basic foundations for realizing automated assembly operations in an optical-tweezers-based assembly cell. This is expected to lead to a reliable, efficient, and automated assembly process for fabricating and prototyping devices and structures consisting of microscale and nanoscale components.