Weekly Seminar: Fall 2010

Date: Friday November 12

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Minjun Kim (Drexel)

Title:*"Bacterial or Cellular Microrobotics for Biofactory-on-a-Chip"*

Abstract

Recently, as the field of engineered microscale robotics matures, a need for control of miniaturized systems has emerged. One approach is utilization of a live organism as an actuator. First, we will discuss the practical integration of bacterial flagellar motors to actuate microrobots for engineering works in microfluidic environments. The ability to integrate multiple levels of functionality with a control hierarchy will be highlighted to show the realization of bacteria-powered microrobots. We will also talk about bacteria-inspired robotic microswimmers with active propulsion. An external rotating magnetic field is generated by a set of electromagnetic coils in an approximate Helmoltz configuration. The magnetic field induces rotation in a flagella conjugated magnetic bead. The flagella act as both a fluidic actuator for device propulsion and as a coupler for a polystyrene bead, which is used in place of a specific drug delivery system, such as a drug filled vesicle. Lastly, *Tetrahymena pyriformis GL* (*T. pyriformis*) will be introduced to show control of eukaryotes for microbiorobotics. By magnetizing ingested ferromagnetic nanoparticles (magnetite, Fe3O4), the swimming direction of individual cell becomes controllable using external time varying magnetic fields. Since endogenous motility of a cell and the artificial magnetotaxis are combined into one system, the motion of the artificial magnetotatic *T. pyriformis* is able to be finely controlled. Also, “Point to point” feedback control was performed in real time with a vision tracking system and two sets of electromagnets, showing controllability of single cell. For improved control of a position and orientation of a cell, a feasible path is planned by randomized roadmap tree (RRT) which is one of the fast path planning schemes. Combining the feedback control and the path planning scheme enables *T. pyriformis* to move to the target with the desired direction, which might be a basic movement for microrobot applications such as assembly.