



For more information: 202-994-6749

MAE SEMINAR SERIES

Expanding the Reach of Robots in Medicine: From Macro to Micro

Dr. Jake Abbott
Institute of Robotics and Intelligent Systems, ETH Zurich

Tuesday, March 20, 2007
Phillips Hall, 7th Floor Conference Room #736
1pm

Abstract

Robotic minimally invasive surgery is now a reality, providing surgeons with a sense of immersion inside the body. However, current telemanipulation systems such as the da Vinci Surgical System are still ultimately limited by having a human operator directly in the control loop. I will discuss our efforts at Johns Hopkins University to develop virtual fixtures. These virtual constraints, implemented in software, provide task assistance to the human operator. Virtual fixtures can act as forbidden regions, keeping the robot manipulator away from potentially dangerous areas, or they can act as guidance modes that assist the operator in moving along desired paths. Our focus was on virtual fixtures that allow the operator to maintain a great deal of control. However, current minimally invasive robotic systems still leave many locations in the body difficult or impossible to access. At ETH Zurich we are developing a wireless magnetically controlled assembled-MEMS intraocular microrobot. Intraocular procedures are unique among *in vivo* procedures in that we have a direct line of site to the microrobot, greatly simplifying the localization problem. The microrobot will allow minimally invasive diagnostic procedures in the eye such as wireless oxygen sensing, as well as surgical procedures such as retinal-vessel cannulation and retinal membrane peeling. In addition to exploring these specific tasks, we have developed a set of governing equations for precise wireless magnetic control. I will also discuss our efforts in the design of modular microrobots as part of the joint European ARES project. The goal of ARES is a system that is swallowed in parts and then assembled in the gastrointestinal tract to perform diagnostic and therapeutic tasks, such as the diagnosis of cancer in the small intestine. At ETH Zurich, we are currently focusing on the inter-module connection/disconnection mechanism, as well as directed self-assembly, with a focus on scalable technologies.

The Speaker

Jake Abbott earned his M.S. in mechanical engineering at the University of Utah in Salt Lake City, where he worked on peripheral nerve control of prostheses. He then moved to Johns Hopkins University in Baltimore, Maryland, where he worked in the field of haptics and telemanipulation. He earned his Ph.D. in mechanical engineering in 2005, and then began his current position as a post-doctoral research associate in the Institute of Robotics and Intelligent Systems at ETH Zurich in Switzerland. At ETH Zurich, Jake leads a team of graduate students in the design of *in vivo* microrobots.