The Chinese University of Hong Kong
Shun Hing Institute of Advanced Engineering
Distinguished Lecture Series 2010

Robotic Surgery Inside the Beating Heart

by

Professor Pierre E. Dupont

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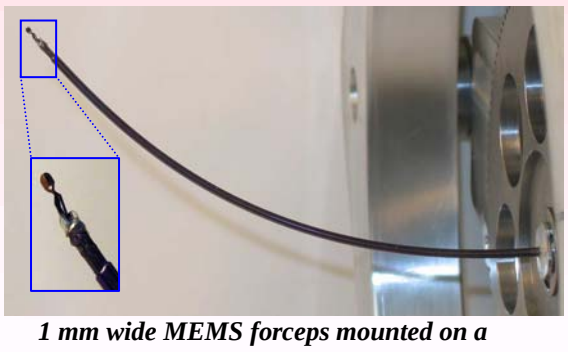
Date: 18 October 2010 (Monday)
Time: 2:30 p.m. – 4:00 p.m.
Venue: Room 1009, 10/F, William MW Mong Engineering Building, CUHK

Abstracts



1 mm wide MEMS forceps mounted on a needle-like robot arm.

Robots have been most successful in applications for which it has been possible to adapt the task to fit the capabilities of the robot. In manufacturing, for example, this has often involved redesigning the product for ease of assembly. In medical applications, it is not possible to redesign the patient, but it is possible to invent new technologies and surgical techniques specifically designed for robotic minimally invasive surgery. One such technology, concentric tube robots, is based on concentrically combining pre-curved elastic tubes. By rotating and extending the tubes with respect to each other, their curvatures interact elastically to position and orient the robot's tip, as well as to control the robot's shape along its length. In this approach, the flexible tubes comprise both the links and the joints of the robot. Since the actuators attach to the tubes at their proximal ends, the robot forms a slender curve comparable in cross section to a catheter, but with a substantially higher tip stiffness. Robot designs are assembled from tube sets based on the surgical procedure and images of the patient's anatomy. This technology requires radically different approaches to solving the standard robotics problems of workspace design, kinematic modeling and real-time control. In this talk, I will discuss our solutions to these challenges illustrated with examples from cardiac surgery where our goal is to convert open-heart surgical procedures to percutaneous beating-heart procedures.

Biography of the Speaker

Pierre E. Dupont is Chief of Pediatric Cardiac Bioengineering at Children's Hospital Boston. His academic appointments include Visiting Professor of Surgery at Harvard Medical School and Professor of Biomedical Engineering at Boston University. His research group develops robotic instrumentation and imaging technology for minimally invasive surgery. He received the B.S., M.S. and Ph.D. degrees in Mechanical Engineering from Rensselaer Polytechnic Institute, Troy, NY, USA in 1982, 1984 and 1988, respectively. From 1988 to 1990, he was a Postdoctoral Fellow in the School of Engineering and Applied Sciences at Harvard University, Cambridge, MA, USA. He subsequently moved to Boston University, Boston, MA, USA where, until recently, he was a Professor of Mechanical Engineering and Biomedical Engineering. He has served in many capacities with the IEEE Robotics and Automation Society including as a member of the Administrative Committee and as an Associate Editor for the Transactions on Robotics & Automation and the Transactions on Robotics. He is currently a member of the Management Committee of the Transactions on Haptics.

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** Light refreshment will be served at 2:15 p.m. before the lecture **