

Title:

Robot Hands for the Real World

by

Robert D. Howe

Thinker in Residence, Deakin University

Professor of Engineering, Harvard School of Engineering and Applied Sciences

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Room na1.417, GTP building (Ground Floor),
Deakin University, Waurn Ponds, Geelong, Australia

RSVP – <http://www.deakin.edu.au/research/cisr/workshops/ieee-smc-vic.php>

Professor Saeid Nahavandi or Trish O'Toole
trish.otoole@deakin.edu.au or Tel: +61 3 5227 1352

Abstract

Manipulating objects in unstructured environments like homes and workplaces is challenging because object properties are not known a priori and sensing is prone to error. Research in this area has largely focused on anthropomorphic hands that are complex, fragile, and difficult to control. We are pursuing an alternate approach that focuses on the passive mechanical behavior of the hand. By integrating carefully-selected joint compliance and adaptive transmissions, we have developed a simple and inexpensive hand that can grasp objects spanning a wide range of size, shape, weight, and position, while using only one motor. The hand is constructed using polymer-based Shape Deposition Manufacturing (SDM), resulting in a robust design that can withstand large impacts. Experimental testing demonstrates that the SDM Hand can autonomously grasp objects despite large positioning errors, while keeping contact forces low. A new hand, the iHY Manipulator, combines optimized passive mechanics with five motors for precision fingertip manipulation. We have also developed a low-cost sensor suite for these hands that includes distributed tactile sensors, flexure joint sensors, and piezoelectric contact sensors. By taking advantage of intrinsic finger compliance, these sensors can rapidly and effectively acquire essential object properties without complex and precise controllers. The combined hand and sensor system can deal with a wide range of objects and tasks, enabling effective grasping and manipulation in many real-world settings.

Biography:

Robert D. Howe is Abbott and James Lawrence Professor of Engineering and Area Dean for Bioengineering at the Harvard School of Engineering and Applied Sciences. Dr. Howe founded the Harvard BioRobotics Laboratory in 1990, which investigates the roles of sensing and mechanical design and motor control, in both humans and robots. His research interests focus on manipulation, the sense of touch, and human-machine interfaces. Biomedical applications of this work include of robotic and image-guided approaches to minimally invasive surgery. Dr. Howe earned a bachelors degree in physics from Reed College, then worked as a design engineer in the electronics industry in Silicon Valley. He received a doctoral degree in mechanical engineering from Stanford University in 1990, and then joined the faculty at Harvard. Dr. Howe is a Fellow of the

IEEE and the AIMBE. He is a recipient of the National Science Foundation Young Investigator Award as well as Best Paper Awards at mechanical engineering, robotics, and surgery conferences. Lab web site: <http://biorobotics.harvard.edu/>.