Department of Biomedical Engineering

Seminar Series

Industrial Robots, Skills and Work-Space Sensing

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Date:	July 20, 2018 (Friday)
Time:	11:00am - 12:00noon
Venue:	B6619 Conference Room, Yeung Kin Man Academic Building

Abstract

Exteroception or robotic work-space sensing is necessary for efficient usage of robots for purposes of manipulation and manufacturing in new and precision-demanding applications—e.g., robotic precision machining, assembly operations, surgical robotics. In particular, the need for sensor networks and distributed sensing poses new scientific and technological challenges. In addition to established measurement technology for geometric and kinematic data such as robot vision and navigation, there is a need for sensor capacity for physical quantities other than geometric or kinematic ones. In this seminar, we review examples of robotic work-space sensing and control and the current needs for new sensors

measuring force, touch, texture, speed, and tool impact. Several robotic assembly use cases would benefit from such new sensor technology. Also, we will compare conditions for sensor-rich and sensor-deprived robotic work spaces. A few case studies of industrial robotics are provided. The role and formalization of robotic skills are discussed.

One way to explore the benefits of exteroception is to start from sensor-deprived robotic work-space control. The traditional way of controlling an industrial robot is to program it to follow desired trajectories using position control. This approach is suitable as long as the accuracy of the robot and the calibration of the work cell is sufficiently precise. In robotic assembly these conditions are usually not fulfilled because of uncertainties, e.g., variability in involved parts and objects not gripped accurately. Using force control is one way to handle these difficulties. Here, two methods of doing force control without a force sensor is evaluated. The methods are based on force estimation from input-output data during closed-loop control with errors and compensations caused by contact forces. The approaches were experimentally verified in a small part assembly task with a kinematically redundant robotic manipulator.

Biography

Prof. Rolf Johansson received the Master-of-Science degree in Technical Physics in 1977, the Bachelor-of-Medicine degree in 1980, the doctorate in control theory 1983, was appointed Docent in 1985, and received the Doctor-of-Medicine degree (M.D.) in 1986, all from Lund University, Lund, Scandinavia. He is fellow of the Swedish Society of Medicine; Fellow of the Royal Physiographic Society, Section of Medicine; and IEEE Fellow. Since 1986 he has been with the Dept. Automatic Control, Lund University, where he is currently Professor of control science. He is Director of Robotics Laboratory at Lund University. In his scientific work, he has been involved in research in adaptive system theory, mathematical modeling, system identification, robotics and signal

processing.

Rolf Johansson is Associate Editor of the scientific journals Mathematical Biosciences, Intelligent Service Robotics, International Journal of Adaptive Control and Signal Processing, and Robotics and Biomimetics. Rolf Johansson was awarded the 1995 biomedical engineering prize (the Ebeling Prize) of the Swedish Society of Medicine for distinguished contribution to the study of human balance through application and development of system analysis and robotics. He was co-recipient of the Best Automation Paper Award from the 2012 IEEE International Conference on Robotics and Automation (ICRA2012), Saint Paul, MN, May 14-18, 2012.

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All are Welcome!

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