Faculty 20th Anniversary Distinguished Lecture

High-Speed Atomic Force Microscopy: Scanner Design and Control Issues

Date : December 14, 2011 (Wednesday)
Time : 4:00 p.m. - 5:00 p.m.
Venue : Room 215, William M. W. Mong Engineering Building, CUHK
Speaker: Prof. Reza Moheimani
The University of Newcastle, Australia

Abstract

Over the last two decades we have observed astonishing progress in nanotechnology. This progress is partially due to the invention of Atomic Force Microscope (AFM) in the 1980s, which has made a significant impact on numerous fields. A conventional atomic force microscope is rather slow, taking up to a minute or longer to develop an image. A high-speed atomic force microscope is needed to acquire high resolution, three-dimensional, time-lapse images of fast processes such as the rapid movement of cells and the diffusion of DNA molecules. In this talk we concentrate on mechanical design of high-speed scanners, the fundamental role of feedback, and the need for model-based control design methods in increasing accuracy and speed of operation of atomic force microscopes. We also will explain how similar ideas have led to the highest reported data storage density in a MEMS-based data storage device, in which an array of thousands of AFM-type levers are used to store digital information as tiny indentation on a polymer storage medium.

Biography

Dr. Reza Moheimani joined The University of Newcastle, Australia in 1997, where he founded and directs the Laboratory for Dynamics and Control of Nanosystems, a multi-million-dollar state-of-the-art research facility dedicated to the advancement of nanotechnology through innovations in systems and control engineering. He is a Professor of Electrical Engineering and an Australian Research Council (ARC) Future Fellow. His current research interests are mainly in the area of dynamics and control at the nanometer scale, and include applications of control and estimation in nanopositioning systems for high-speed scanning probe microscopy, modeling and control of micro-cantilever based devices, control of electrostatic microactuators in microelectromechanical systems (MEMS) and control issues related to ultrahigh-density probe-based data storage systems.

Dr. Reza is a Fellow of IEEE, a Fellow of IFAC and a Fellow of the Institute of Physics (UK). He is a co-recipient of the 2007 IEEE Transactions on Control Systems Technology Outstanding Paper Award, and the 2009 IEEE Control Systems Technology Award, together with a group of researchers from IBM Zurich Research Labs, where he has held several visiting appointments. He has served on the editorial board of a number of journals including the IEEE Transactions on Control Systems Technology, the IEEE/ASME Transactions on Mechatronics and Control Engineering Practice, and has chaired several international conferences and workshops.

***** ALL ARE WELCOME *****

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