



Dean of Engineering New Professor Lecture Series

Fathi Ghorbel

Department of Mechanical Engineering and Materials Science

“Robotics: Dynamics, Sensing, Control and Scaling”

Since its introduction into our vocabulary by the Czech playwright, Karel Capek, in his 1920 play “Rossum’s Universal Robots,” the term “robot” has been used to refer to systems that operate with some degree of autonomy using sensors and actuators. Robots have been built in many shapes and sizes, ranging from the humanoid devices envisioned by Capek to huge earth-moving robots on one extreme and nanomanipulators moving individual molecules on the other extreme. Robotics is a relatively young field of technology that crosses traditional engineering and science boundaries. In particular, robots have been introduced in a variety of disciplines including manufacturing, space, medicine, entertainment, military, personal service, undersea, and most recently, nanotechnology.

This talk highlights Dr. Ghorbel’s research in robotics and focuses on issues related to dynamics, sensing, actuation, control and scaling. He will address robotic modeling and control by presenting serial and parallel robots, which are typically used in manufacturing, entertainment and medicine. Serial robots are open kinematic chains modeled as nonlinear ordinary differential equations, while parallel robots are closed kinematic chains modeled as nonlinear differential-algebraic equations. He will highlight the modeling and control issues and show how the dynamic model structure is exploited in the design of advanced nonlinear and adaptive control laws, and will illustrate several of these concepts with laboratory-scale robots. Second, he will address locomotion and sensing by presenting the Inspector Bot, a crawler robot his research group developed to carry a variety of sensors inside underground and normally impossible to reach energy pipes, to inspect them from the inside for cracks and other defects, and to monitor their health. In particular, he will discuss Ultrasonic and Magnetic Flux Leakage sensing, and highlight the forward and inverse problems in defect recognition. The pipe Inspector Bot will find applications in nuclear plants, desalinization plants, food processing plants, and in the oil and gas industry, including underground gas and oil pipes, coiled tubing, heat exchangers and refineries. Finally, he will address scaling by introducing the new notion of nanorobotics and discussing whether the field of robotics is there yet.

McMurtry Auditorium, Duncan Hall
Tuesday, April 10, 2007
4:00 pm

Reception immediately following in Martel Hall

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