

## Introduction to Microelectromechanical Systems

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### **ABSTRACT**

*Microelectromechanical systems (MEMS) enable the development of smart products and systems by augmenting the computational ability of microelectronics with the perception and control capabilities of microsensors and microactuators. The sensors gather information from the environment through measuring mechanical, thermal, biological, chemical, optical, and/or magnetic phenomena. The electronics process this sensor information and direct the actuators to respond by moving, positioning, regulating, pumping, and/or filtering, thereby controlling the environment for a desired purpose. MEMS devices are emerging as product performance differentiators in both commercial and defense markets such as automotive, aerospace, medical, industrial process control, electronic instrumentation, office equipment, appliances, telecommunications, and optical systems.*

*An introduction to the technology will be presented, including description of concepts, terminology, potential impact, and the multidisciplinary nature of the field. The lecture will also incorporate an overview of the technology in the form of example devices and applications. Anisotropic etching of silicon and etch stop techniques, as well as wafer bonding will be introduced. Surface micromachining with emphasis on polysilicon processes, as well as photoresist processes coupled with metal plating will be scanned. Mentions of MEMS design, modeling, material science, testing, reliability, and packaging will be made in the context of the examples included in the lecture.*

### **BIOGRAPHY**

Mehran Mehregany received his B.S. in Electrical Engineering from the University of Missouri in 1984, and his M.S. and Ph.D. in Electrical Engineering from Massachusetts Institute of Technology in 1986 and 1990, respectively. From 1986 to 1990, he was a consultant to the Robotic Systems Research Department at AT&T Bell Laboratories, where he was a key contributor to ground-breaking research in microelectromechanical systems (MEMS). In 1990, he joined the Department of Electrical Engineering and Applied Physics at Case Western Reserve University as an Assistant Professor. He was awarded the Nord Assistant Professorship in 1991, was promoted to Associate Professor with tenure in July 1994, and was promoted to Full Professor in July 1997. He held the George S. Dively Professor of Engineering Endowed Chair from January 1998 until July 2000, when he was appointed the BFGoodrich Professor of Engineering Innovation. He served as the Director of the MEMS Research Center at CWRU from July 1995 until July 2000. Professor Mehregany is

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well known for his research in the area of MEMS, and his work has been widely covered by domestic and foreign media. He has over 200 publications describing his work, holds 12 U.S. patents, and is the recipient of a number of awards/honors. He served as the Editor-in-Chief of the Journal of Micromechanics and Microengineering from January 1996 to December 1997, and is Assistant-to-the-President of the Transducers Research Foundation. His research interests include silicon and silicon carbide MEMS, micromachining and microfabrication technologies, materials and modeling issues related to MEMS and IC technologies, and MEMS packaging.

Mehran Mehregany is the Founder and served as the President (July 1993 to March 1999) of Advanced Micromachines Incorporated (Cleveland, Ohio), a company in the MEMS area. Advanced Micromachines Incorporated was acquired by The BFGoodrich Corporation in March 1999. He founded NineSigma, Inc., an information technology company, in February 2000 and served as its CEO (June 2000 to January 2001) and CTO (January 2001 to August 2001), during which period he successfully completed initial rounds of private financing and grew the company to 15 employees. He co-founded FiberLead, Inc., an optical telecommunications company, in September 2000 and served as its CEO until September 2001, during which period he successfully completed the early stage round of venture capital financing and grew the company to 5 employees.