

**UNIVERSITY OF MACAU  
FACULTY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT of  
ELECTROMECHANICAL ENGINEERING**

Ref: FST/SEM/033/2010

**“Modeling and Control of Hysteresis  
Nonlinearities in Smart Actuators”**

by

**Prof. Chun-Yi Su**

*Department of Mechanical and Industrial Engineering  
Concordia University  
1455 de Maisonneuve Blvd. West  
Montreal, Quebec, Canada*

**Date : 01/06/2010 (TUESDAY)  
Time : 17:00 – 18:30  
Venue : JM12**

**Abstract**

Hysteresis nonlinearities are very common in magnetic materials, smart materials and industrial systems. For decades, the existence of such nonlinearities have provided one of the most difficult challenges to control design engineers since the entire Laplace domain and most state space control design techniques were developed exclusively for differentiable linear or nonlinear systems. Hence, the existence of hysteresis nonlinearities in smart material based actuators and systems were neglected and the controllers were designed based on the nominal

smooth systems. When the systems are considered with non-differentiable nonlinearities, these methods encountered substantial difficulties in the analysis, model fitting and control design stages. It was extremely difficult, if not impossible, to design or prove stability of such systems. The development of techniques for the identification of such nonlinearities in realistic industrial plants has emerged as a significant problem in itself.

This talk is intended to raise awareness of modeling and control techniques and to provide an opportunity to discuss state-of-the-art solutions for the problems. The presentation and discussion will range from modeling of hysteresis, to the design of corresponding control schemes, especially in the absence of complete information concerning the system model and state. The talk is designed to appeal to an audience from different backgrounds. People working in the area of control will have a chance to interchange ideas and to view problems from different perspectives. People working in other areas will also benefit by understanding the new methods and technologies developed for control's point of view.

## **Biography**

Chun-Yi Su received his B.E. degree in control engineering from Xian University of Technology in 1982, his M.E. and Ph.D. degrees in control engineering from South China University of Technology, China, in 1987 and 1990, respectively.

After long stint at the University of Victoria (Canada), he joined the Concordia University (Canada) in 1998, where he is currently Professor of Mechanical Engineering and holds the Concordia Research Chair in Control. He has also held several short-time visiting positions such as Chang Jiang Chair Professorship appointed by China's Ministry of Education and JSPS Fellow in Japan.

Dr. Su's research covers control theory and its applications to various mechanical systems. He is the author or co-author of over 300 publications, which have appeared in journals, as book chapters and in conference proceedings. In addition to his academic activities, he has worked extensively with industrial organizations on various projects.

Dr. Su has been an Associate Editor of IEEE Transactions on Automatic Control, IEEE Transactions on Control Systems Technology, Mechatronics, Control

Engineering Practice (both are the journals of IFAC), and Journal of Control Theory & Applications. He also sits on the Editorial Board of 8 different journals including International Journal of Advanced Mechatronic Systems. He has served as the organizing committee member for many conferences including Program Chair of the 2007 IEEE Conference on Control Applications, the General Chair of the 2004 International Conference on Dynamics, Instrumentation and Control (CDIC'04), General Co-Chair for the Fourth IEEE International Conference on Control and Automation (ICCA'03).

**ALL ARE WELCOME!**