2011-2012

Graduate Seminar Series

The Department of Mechanical Engineering – Engineering Mechanics

Proudly Presents

Professor Tomas Co
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Michigan Technological University

Dr. Tomas Co received his B.S. degree from the University of Philippines, Diliman, Philippines, in 1981 and his Ph.D. degree from the University of Massachusetts, Amherst, MA in 1988, both in chemical engineering. In 1988 to 1989, he was a postdoctoral researcher at the Process Modeling and COntrol Center at Lehigh University, Bethlehem, PA. In 1997 to 1998, he was a visiting research engineer at the Honeywell Technology Center in Minneapolis, MN. In 2005 to 2006, he was a visiting professor at Korea University in Seoul, South Korea. From 1989 to the present, he has been a faculty member at the Department of Chemical Engineering at Michigan Technological University, Houghton, MI. His research interests include large scale systems, process integrity, adaptive control, process modeling, relay stabilization, hybrid control, neural networks and fuzzy logic control.

Thursday, Feb. 23, 2012 **4:00 – 5:00 p.m.** **Room 112, ME-EM Bldg.**

Relay Stabilization and Bifurcations of Unstable Processes with Time Delay

Relay control is one of the simplest methods for stabilizing open-loop unstable processes by producing limit cycles. It is also used for parameter identification of unstable processes for designing other types of controllers. In this talk, we obtain the exact analysis of the limit cycles for a class of high-order unstable single input-single output (SISO) processes using relay control. A key technical lemma provides two nonlinear equations whose solutions provide the time periods of the upswing and downswing modes. Analytical and graphical methods are then used to determine the existence and multiplicity of the limit cycles. Also, necessary and sufficient conditions have been developed to determine the stability of the limit cycles. These tools then allow for the bifurcation analysis of the limit cycles based on variations in time delay. One interesting result is the presence of irregular stabilization, where increasing time delay could actually regain stability that was lost at smaller time delays. The results are then combined to provide a set of necessary conditions for relay stabilization. These conditions can be represented by a compact pyramid region which then yields some useful guidelines for the synthesis of additional compensators for relay-stabilization.

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