



**The Center for Control, Dynamical Systems, and Computation
University of California at Santa Barbara
Fall 2006 Seminars
Presents**

An Information Theoretic Viewpoint to Performance Bounds of Feedback Systems: Optimality Results and Open Problems

by Nuno Martins

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Friday, October 6th, 2006 3:00 - 4:00 PM Harold Frank Hall 4162

Abstract:

In this seminar, discussion will be based on recent results on universal bounds of performance for feedback systems.

Using notions, from Information Theory, such as mutual information and (differential) entropy, I characterize conservation laws that hold under causality, which is a basic attribute of physical systems. In particular, I show that the differential entropy, induced by external excitation, cannot be reduced by feedback. This principle is related to Bode's integral formula, originally derived for linear and time-invariant feedback systems. This analysis extends Bode's ideas to arbitrary feedback, while providing a suitable framework, for considering the case where a finite-horizon preview, of the external excitation, is available. I also characterize an information flow inequality that can be used for establishing a universal bound of performance, in the frequency domain. These results are expressed as bounds, which, holding in great generality, are useful in establishing the optimality of certain feedback schemes.

About the Speaker:

Nuno C Martins received the Licenciatura and the MS. degrees in electrical engineering from Instituto Superior Tecnico, Lisbon, Portugal, and the Ph.D. degree in electrical engineering and computer science from Massachusetts Institute of Technology (MIT), Cambridge, in 2004.

From 2004 until 2005, he was a Postdoctoral Associate at the Laboratory for Information and Decision Systems (MIT). Currently, he is Assistant Professor at the Department of Electrical and Computer Engineering, University of Maryland, College Park. He is also affiliated with the Institute for Systems Research and his research interests include fundamental limits of feedback and the fusion between control theory and information theory.

Dr. Martins received the 2006 American Automatic Control Council O. Hugo Schuck Award (theory) and two fellowships, in 1999 and 2004, from the European Social Fund and the Portuguese Foundation for Science and Technology.
