



## SYSTEMS, CONTROLS, AND ROBOTICS SEMINAR SERIES



### **Dr. Tryphon Georgiou**

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Friday, February 28, 2014

3:45 p.m. / 100 Harrington Education Classroom Center

### **Geometry of Spectral Analysis for Statistical Estimation, Tracking and Signal Detection**

#### **ABSTRACT**

A variety of sensor technologies, ranging from radar to medical imaging, rely critically upon efficient ways to estimate the power distribution from recorded signals. Robustness and accuracy are of at most importance, yet there is no universal agreement on how these are to be quantified. In the talk we will motivate the need for ways to compare power spectral distributions and explain how these can be used to quantify spectral uncertainty and to devise techniques for improving resolution. Metrics, in any field of science, must relate to physically meaningful properties of the objects under consideration. In this spirit, we will discuss certain natural notions of distance between power spectral densities. First we will present a geometric framework for studying power spectra which is based on optimal prediction. Analogies and will be drawn with classical Fisher information geometry which will then motivate our transition to a complementary viewpoint based on optimal mass transport. The relevance of these theories will be highlighted with applications to speech and image analysis. We will then concluding by focusing on the geometry of vector-valued processes and corresponding metrics for multivariable power spectra. We will detail metrics based on optimal prediction of vector-valued processes and present connections between quantum analogues of the Fisher metric and a matrix-valued formulation of optimal mass transport.

#### **BIO**

Tryphon T. Georgiou received the Diploma in Mechanical and Electrical Engineering from the National Technical University of Athens, Greece, in 1979, and the Ph.D. degree from the University of Florida, Gainesville, in 1983. He has served on the faculty of Florida Atlantic and Iowa State universities before joining the University of Minnesota in 1989. He is currently a Professor of Electrical and Computer Engineering, a co-director of the Control Science and Dynamical Systems Center (1990-present), and holds the Vincentine Hermes-Luh chair of Electrical Engineering. He is a co-recipient of three George Axelby Outstanding Paper awards by the IEEE Control Systems Society, for the years 1992, 1999, and 2003. In 1992 and in 1999 he received the award both times for joint work with Prof. Malcolm C. Smith, and in 2003 for joint work with Professors Chris Byrnes and Anders Lindquist. He is a Fellow of the IEEE and a Foreign member of the Royal Swedish Academy of Engineering Sciences (IVA).

Pizza will be served at 3:30 p.m.