Dwight Look College of ENGINEERING
TEXAS A&M UNIVERSITY

# SEMINAR

## SYSTEMS, CONTROLS AND ROBOTICS SEMINAR


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Friday, February 27th, 2015
4:00 p.m. / 202 James J. Cain '51 Building

# Convex Sets, Conic Matrix Factorizations and Rank Lower Bounds


## ABSTRACT

In optimization one often represents convex sets in terms of convex cones. Such representations or 'lifts' of a convex set are especially useful if the cone admits efficient algorithms for linear optimization over its affine slices, as in the classical cases of linear and semidefinite programming. Despite the fact that these techniques are widely used, there are many aspects (particularly, existence and efficiency) that are still poorly understood. In this talk we discuss the relationship between conic representations of convex sets, and a special "conic" factorization of an operator associated to the convex set, generalizing earlier results of Yannakakis on polyhedral lifts of polytopes and nonnegative factorizations. When the cones live in a family, our results lead to the definition of the rank of a convex set with respect to this family (e.g., the positive semidefinite rank of a convex set), as well as techniques for lower bounding these ranks. We will provide a gentle introduction to these techniques, emphasizing geometric intuition, open questions as well as recent results. Based on joint work with Joao Gouveia, Hamza Fawzi, James Saunderson and Rekha Thomas.


## BIO

Pablo A. Parrilo is a Professor of Electrical Engineering and Computer Science at the Massachusetts Institute of Technology. He is currently Associate Director of the Laboratory for Information and Decision Systems (LIDS), and is also affiliated with the Operations Research Center (ORC). Past appointments include Assistant Professor at the Automatic Control Laboratory of the Swiss Federal Institute of Technology (ETH Zurich), Visiting Associate Professor at the California Institute of Technology, as well as short-term research visits at the University of California at Santa Barbara (Physics), Lund Institute of Technology (Automatic Control), and University of California at Berkeley (Mathematics). He received an Electronics Engineering undergraduate degree from the University of Buenos Aires, and a PhD in Control and Dynamical Systems from the California Institute of Technology. His research interests include optimization methods for engineering applications, control and identification of uncertain complex systems, robustness analysis and synthesis, and the development and application of computational tools based on convex optimization and algorithmic algebra to practically relevant engineering problems. Prof. Parrilo has received several distinctions, including a Finmeccanica Career Development Chair, the Donald P. Eckman Award of the American Automatic Control Council, the SIAM Activity Group on Control and Systems Theory (SIAG/CST) Prize, the IEEE Antonio Ruberti Young Researcher Prize, and the Farkas Prize of the INFORMS Optimization Society.

Pizza will be served at 4:00 p.m.