Title: Network Science and Kuramoto Oscillators

Abstract: Network systems are mathematical models for the study of cooperation, propagation, synchronization and other dynamical phenomena that arise among interconnected agents. Network systems are widespread in science as fundamental modeling tools. They also play a key growing role in technology, e.g., in the design of power grids, cooperative robotic behaviors and distributed computing algorithms. Their study pervades applied mathematics.

This talk will review established and emerging frameworks for modeling, analysis and design of network systems. I will survey the available comprehensive theory for linear network systems and then highlight selected nonlinear concepts. Next, I will focus on recent developments on the analysis of security and transmission capacity in power grids. I will review the Kuramoto model of coupled oscillators and present recent results on its synchronization behavior.

Biography: Francesco Bullo is a Professor with the Mechanical Engineering Department and the Center for Control, Dynamical Systems and Computation at the University of California, Santa Barbara. He was previously associated with the University of Padova, the California Institute of Technology, and the University of Illinois. His research interests focus on network systems and distributed control with application to robotic coordination, power grids and social networks. He is the coauthor of "Geometric Control of Mechanical Systems" (Springer, 2004) and "Distributed Control of Robotic

Networks" (Princeton, 2009); his forthcoming "Lectures on Network Systems" is available on his website. He received best paper awards for his work in IEEE Control Systems, Automatica, SIAM Journal on Control and Optimization, IEEE Transactions on Circuits and Systems, and IEEE Transactions on Control of Network Systems. He is a Fellow of IEEE and IFAC. He has served on the editorial boards of IEEE, SIAM, and ESAIM journals, and will serve as IEEE CSS President in 2018.