CLEAN ENERGY INSTITUTE
UNIVERSITY of WASHINGTON

Interdisciplinary Seminar Series Lecture:
Optimal Power Flow for Future Smart Grid

We envision a future network with hundreds of millions of active endpoints. These are not merely passive loads as are most endpoints today, but endpoints that may generate, sense, compute, communicate, and actuate. They will create both a severe risk and a tremendous opportunity: an interconnected system of hundreds of millions of distributed energy resources (DERs) introducing rapid, large, and random fluctuations in power supply and demand, voltage and frequency, and our increased capability to coordinate and optimize their operation. We will discuss some of the control challenges in such a network and then focus on a specific problem, the optimal power flow (OPF) problem, as an illustration.

OPF seeks to optimize a certain objective, such as power loss, generation cost or user utility, subject to Kirchhoff's laws, power balance as well as capacity, stability and contingency constraints on the voltages and power flows. It is a fundamental problem that underlies many power system operations. It is nonconvex and many algorithms have been proposed to solve it approximately. A new approach via convex relaxation of OPF has been developed in the last few years. I will survey the state of the art relaxations based on semidefinite programming, chordal extension, and second-order cone programming in both bus injection model and branch flow model. I will explain the relations among these relaxations, and the various sufficient conditions in the literature that guarantee the exactness of these relaxations.

Thursday, February 13
4:00 – 5:00 PM
Physics/Astronomy Auditorium (PAA) A110

Reception will take place in PAA at 3:30 PM prior to start of lecture

Steven H. Low, Ph.D.

Professor, Computing & Mathematical Sciences and Electrical Engineering Departments, Caltech

Steven H. Low is Professor of the Computing & Mathematical Sciences and Electrical Engineering Departments at Caltech. Before that, he was with AT&T Bell Laboratories, Murray Hill, NJ, and the University of Melbourne, Australia. He was a co-recipient of IEEE best paper awards, the R&D 100 Award, and an Okawa Foundation Research Grant. He is on the Technical Advisory Board of Southern California Edison and was a member of the Networking and Information Technology Technical Advisory Group for the US President's Council of Advisors on Science and Technology (PCAST) in 2006. He is a Senior Editor of the IEEE Journal on Selected Areas in Communications, a Senior Editor of the IEEE Trans. Control of Network Systems, a Steering Committee Member of the IEEE Trans. Network Science & Engineering, and on the editorial board of NOW Foundations and Trends in Networking, and in Power Systems. Hei s an IEEE Fellow and received his B.S. from Cornell and PhD from Berkeley, both in EE.