University of Southern California

DANIEL J. EPSTEIN DEPARTMENT OF
INDUSTRIAL AND SYSTEMS ENGINEERING

## EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR

# *Maximum Pressure Policies for Stochastic Processing Networks*

## Jim Dai

**Professor of Operations Research, Cornell University**
**The Chandler Family Chair of ISyE, Georgia Tech (on leave)**

**ABSTRACT**

Stochastic processing networks model complex systems including semiconductor wafer fabrication lines, networks of data switches, and large-scale call centers. Key performance measures of such a network include throughput and average cycle time. Elements of an operational policy may include input control, sequencing, and routing; the choice of such a policy can dramatically affect network performance.

I will first demonstrate that even in simple networks, commonly used operational policies such as first-in-first-out sequencing may perform badly, failing to achieve even "throughput optimality." I will then introduce a family of policies known as maximum pressure policies. Such a policy needs only local or semi-local congestion information to be implemented. Often, its implementation does not require arrival rate information which can be difficult to be estimated reliably.

Next, I will focus on two appealing properties of maximum pressure policies. (1) These policies are shown to be throughput optimal, regardless of the processing network's topology or parameter values. (2) Such a policy is further shown to asymptotically minimize a certain diffusion-scaled quadratic holding cost when the network satisfies a heavy traffic condition and a complete resource pooling condition. Finally, I will discuss some recent research progress on these policies.

Jim Dai is currently on leave from Georgia Tech. This talk is based on joint works with Wuqin Lin at Kellogg School of Business of Northwestern University.

## FRIDAY, JANUARY 17, 2014
## SEELEY G. MUDD HALL (SGM) ROOM 601
## 2:00 – 3:30 PM

**SPEAKER BIO - JIM DAI**

Jim Dai is a professor in the School of Operations Research and Information Engineering (ORIE) of Cornell University. He is currently on leave from his Edenfield Professor of Industrial & Systems Engineering at Georgia Institute of Technology, where he has been a faculty member for 22 years. He is a Special Term Professor at Tsinghua University and a Visiting Professor in Decision Sciences at National University of Singapore. For more than twenty years, he has worked on stochastic models arising from communications, manufacturing, and service systems that include data switches, semiconductor wafer fabrication lines, call centers, and healthcare-delivery systems.

Jim Dai received B.A. and M.S. degrees from Nanjing University and a Ph.D. degree from Stanford University, all in mathematics. He is an elected fellow of Institute of Mathematical Statistics and an elected fellow of Institute for Operations Research and the Management Sciences (INFORMS). His awards for research contributions include the Best Publication Award in 1997 and The Erlang Prize in 1998, both from the Applied Probability Society of INFORMS. He delivered the Markov Lecture at INFORMS national meeting in October 2012. He is the Editor-in-Chief for Mathematics of Operations Research, a past Area Editor for Operations Research, and a past Series Editor for Handbooks in Operations Research and Management Science.

***Research Interests***

Stochastic processing networks, Fluid and Diffusion models of queuing networks, Impulse, singular and drift controls of diffusions, Customer contact center management, Patient flow management in hospitals, Semiconductor wafer manufacturing, Airline Revenue management, Algorithm trading, and Orderbook dynamics.