

# SPECIAL INDUSTRIAL & SYSTEMS ENGINEERING SEMINAR

**Friday, May 4**

11:00 AM – Graduate Seminar

**Mechanical Engineering Room 3125 (Room Change)**



## State-dependent Rare-event Simulation for Heavy-tailed Multi-server Queues

Professor Jingchen Liu  
Department of Statistics  
Columbia University

In this talk, he will discuss the first provably efficient simulation algorithm for steady-state estimation of long delays in a positive recurrent two-server ( $G/G/2$ ) queue with heavy-tailed service requirement. Long delays are usually caused by one or two customers (depending on the traffic intensity) who have extremely large service requirement and block the servers for long time. We propose a three-step program to design the algorithm and prove its efficiency. First, we adopt a mixture family of changes-of-measure; second, propose an appropriate Lyapunov inequality to control the variance of our estimator; third, construct a Lyapunov function (the solution to the Lyapunov inequality) and tune various parameters to verify the inequality. Because of the upper bound provided by the Lyapunov function, our method also suggests an asymptotic approximation of the rare-event probability. Therefore, rare-event simulation and large deviations analysis for heavy-tailed models are connected naturally. Our strategy including the mixture family, the construction of Lyapunov function, and proof techniques can solve a large class of problems. We shall also mention other large deviations problems involving multidimensional heavy-tailed models for which our program can be successfully applied.

BIO: S. Jingchen Liu is an Assistant Professor in the Department of Statistics at Columbia University. Jingchen received his Ph.D. in statistics from Harvard University in June, 2008.

**FOR MORE INFORMATION ON PROFESSOR LIU'S RESEARCH,  
PLEASE VISIT: <http://stat.columbia.edu/~jcliu/>**