

**DANIEL J. EPSTEIN DEPARTMENT OF  
INDUSTRIAL AND SYSTEMS ENGINEERING**

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**EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR**

***Resilient Control for Dynamic  
Network Flows***

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Civil and Environmental Engineering  
University of Southern California**

**ABSTRACT**

I begin the talk by giving a brief overview of some of my results on vehicle routing problems and dynamical queues. Specifically, I highlight the result that the scaling of the length of the shortest closed curve under a minimum radius of curvature constraint and passing through  $n$  points sampled from a uniform distribution in a plane is  $n^{2/3}$  almost surely. I also discuss a formulation of dynamical queues that is inspired by human operators, and present maximally stabilizing task release control policies for such queues.

In the main part of the talk, I present provably-resilient distributed control policies for dynamic flows over networks, and illustrate the results in the context of urban transportation networks. Specifically, I present a novel class of locally cooperative routing policies. These policies, when used as local adjustments to standard global route choice models, lead to stability of classical transportation equilibria in the dynamical setting. The same policies also render maximum resilience to the network against malicious disruptions. These results rely on a combination of tools from network flows, evolutionary game theory and monotone dynamical systems, and particularly highlight the effect of cascade phenomena on resilience.

**TUESDAY, SEPTEMBER 11, 2012  
ANDRUS GERONTOLOGY BLDG (GER) ROOM 309  
3:30 – 5:00 PM**

## **BIO**

Ketan Savla is an assistant professor in the Sonny Astani Department of Civil and Environmental Engineering at the University of Southern California. Prior to that, he was a research scientist in the Laboratory for Information and Decision Systems at MIT. He obtained his Ph.D. in Electrical Engineering and M.A. in Applied Mathematics, both in 2007, from University of California at Santa Barbara, as well as M.S. in Mechanical and Industrial Engineering from University of Illinois, Urbana-Champaign in 2004. His current research interest is in control and optimization techniques for complex dynamical networks, human-in-the-loop systems, and mobile robotic networks. His awards include a best thesis award from UCSB.