Double Talk

AMIR DEMBO (Stanford) and YUVAL PERES (Microsoft)

Abstract:

Talk 1: Amir Dembo (Stanford)

Title: Large deviations theory for chemical reaction networks.

The microscopic dynamics of well-stirred networks of chemical reactions are modeled as jump Markov processes. At large volume, one may expect in this framework to have a straightforward application of large deviation theory. This is not at all true, for the jump rates are typically neither globally Lipschitz, nor bounded away from zero, with both blowup and absorption as quite possible scenarios.

In joint work with Andrea Agazzi and Jean-Pierre Eckman, we utilize Lyapunov stability theory to bypass this challenge and to characterize a large class of network topologies that satisfy the full Wentzell-Freidlin theory of asymptotic rates of exit from domains of attraction.

Talk 2: Yuval Peres (Microsoft)

Title: Trace reconstruction for the deletion channel

Abstract: In the trace reconstruction problem, an unknown string $x$ of $n$ bits is observed through the deletion channel, which deletes each bit with some constant probability $q$, yielding a contracted string. How many independent outputs (traces) of the deletion channel are needed to reconstruct $x$ with high probability?

The best lower bound known is linear in $n$. Until 2016, the best upper bound was exponential in the square root of $n$. We improve the square root to a cube root using statistics of individual output bits and some inequalities for Littlewood polynomials on the unit circle. This bound is sharp for reconstruction algorithms that only use this statistical information. (Similar results were obtained independently and concurrently by De O’Donnell and Servedio). If the string $x$ is random, we can show a subpolynomial number of traces suffices by comparison to a random walk. (Joint works with Fedor Nazarov, STOC 2017, with Alex Zhai, FOCS 2017 and with Nina Holden & Robin Pemantle, preprint (2017).)