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Qi He* (qhe@wayne.edu), 656 W.Kirby St, Fab 1256, Detroit, MI 48201, and **George Yin** and **Qing Zhang**. *Large Deviations for Two-Time-Scale Systems Driven by Nonhomogeneous Markov Chains and Associated Optimal Control Problems.*

This presentation deals with the large deviations principles for systems driven by a continuous-time Markov chain with two-time scales and related optimal control problems. A main characteristic of our setup is the Markov chain is time inhomogeneous. The use of two-time-scale formulation stems from our effort of reducing computational complexity in a wide variety of applications in control, optimization, and systems theory. Starting with a rapidly fluctuating Markov chain, under irreducibility conditions, we derive both large deviations upper and lower bounds first for a fixed terminal time and then for time-varying dynamic systems. Finally we present an example of application of this result in controlled dynamic systems. (Received August 17, 2011)