Malwina Luczak

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Title: Averaging over fast variables in the fluid limit for Markov chains

Abstract: We set out a general procedure which allows the approximation of certain Markov chains by the solutions of differential equations. The chains considered have some components which oscillate rapidly and randomly, while others are close to deterministic. The limiting dynamics are obtained by averaging the drift of the latter with respect to a local equilibrium distribution of the former.

A general fluid limit estimate is proved. This is then illustrated in analysing a queueing model introduced by Mitzenmacher et al., which is a variant with {\em memory} of the `join the shortest queue' or `supermarket' model. A proof is given of the limit-picture obtained by Mitzenmacher et al., for a stable system in which the number of queues and the total arrival rate are large. In the limit, the empirical distribution of queue sizes satisfies a differential equation, while the memory of the system oscillates rapidly and randomly.

This is joint work with James Norris