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Synchrony in stochastic pulse-coupled neuronal network models

Many pulse-coupled dynamical systems possess synchronous attracting states. Even stochastically driven model networks of Integrate and Fire neurons demonstrate synchrony over a large range of parameters. We study the interplay between fluctuations which de-synchronize and synaptic coupling which synchronizes the network by calculating the probability to see repeated cascading total firing events, during which all the neurons in the network fire at once. The mean time between total firing events characterizes the perfectly synchronous state, and is computed from a first-passage time problem in terms of a Fokker-Planck equation for a single neuron.