An elapsed time model for strongly coupled inhibitory and excitatory neural networks

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The elapsed time model has been widely studied in the context of mathematical neuroscience with many open questions left. The model consists of an age-structured equation that describes the dynamics of interacting neurons structured by the elapsed time since their last discharge. Our interest lies in highly connected networks leading to strong nonlinearities where perturbation methods do not apply. To deal with this problem, we choose a particular case which can be reduced to delay equations.
We present a general convergence result to a stationary state in the inhibitory and the weakly excitatory cases. Moreover, we show the existence of particular periodic solutions with jump discontinuities in the strongly excitatory case. Finally, we present some numerical simulations which ilustrate various behaviors, which are consistent with the theoretical results.

Références

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[3] K. Pakdaman, B. Perthame, D. Salort. *Relaxation and self-sustained oscillations in the time elapsed neuron network model*. SIAM J. Appl. Math., **73(3)**, 1260–1279, 2013.

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