Neuron-like dynamics in ensemble of inhibitory coupled Rulkov elements

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At the present moment there are multiple experimental evidences concerning some types of neural activity that governs different neuronal processes. One of the most important types of such activity is sequential switching activity between individual neurons and groups of neurons. It governs processes in sensory [1] and motor [2] systems and underlies cognitive processes [3]. In the simple case ensembles that are able to reproduce predescribed activity contain only a few neurons.

We study three Rulkov neuron-like elements [4]-[6] with mutual inhibitory couplings. In order to receive more biological relevant description of couplings we consider main features of real biolological inhibitory couplings, such as dependence of postsynaptic element activity level on presynaptic element activity level and inertia of couplings. Constructed in such a way model is discrete and so it is very easy to numerical analysis.

Using the toolkit of nonlinear dynamics we study numerically different dynamical regimes, which can be obtained in this motif by governing coupling parameters, and bifurcation transition between them.

References

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