Complex Network of Neuronal Reaction-Diffusion systems: Long-time Behavior and Self-organization

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Abstract

After a general introduction on Complex systems, interaction networks and synchronization of dynamical systems, we focus on the long time behavior of complex networks of reaction- diffusion (RD) systems. We prove the existence of the global attractor and a L^∞-bound for a network of n RD systems with d variables each. This allows us to prove the identical synchronization for general class of networks and establish the existence of a coupling strength threshold value that ensures such a synchronization. We then apply these results to some particular networks with different structures (i.e. different topologies) and perform numerical simulations. We found out theoretical and numerical heuristic laws for the minimal coupling strength for synchronization relatively to the number of nodes and the network topology, and discuss the link between spatial dimension and synchronization.