SEMINARIOS DEL DEPARTAMENTO DE FÍSICA FUNDAMENTAL

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" Dynamics of networks with time-varying connections: on the interplay of node dynamics, coupling delays and network fluctuations"

Abstract:

Coupling delays are ubiquitous in many real-life networks: it takes time for information to travel in communication networks, or between coupled optical elements. In the brain a coupling delay between interacting neurons arises from the conduction time of an electric signal along the axon. Here, we study the effect of a topology that changes over time in such delay-coupled networks. Network fluctuations are essential features of, for instance, interacting neurons, where synaptic plasticity continuously changes the topology or networks modelling social interactions.

We consider a topology that varies among an ensemble of directed small-world networks of chaotic nodes. The dynamics is characterized by three timescales: the internal time scale of the node dynamics, the connection delay along the links, and the timescale of the network fluctuations. Evaluating the synchronization properties, we find that, when the network fluctuations are much faster than the other time scales, the synchronized state is stabilized by the fluctuations, while it destabilises with increasing network time. Concentrating on a linearised model, we develop an analytic theory that explains these results. In two limit cases the system can be reduced to an "effective" topology: In the fast switching approximation, the effective network topology is the arithmetic mean over the different topologies. In the slow network limit, when the network fluctuation time scale is equal to the coupling delay, the effective adjacency matrix is the geometric mean over the adjacency matrices of the different topologies. In the intermediate regime the system shows a sensitive dependence on the ratio of time scales, and specific topologies.

Jueves, 7 de junio de 2018, 16:00 h.

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