Seminário de sistemas dinâmicos e estocásticos

Departamento de Matemática - IMECC - UNICAMP

Dynamics on Heterogeneous Networks: Mean Field Reduction and Synchronisation.

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Resumo:

Take a collection of N identical dynamical systems $\{(M, f)\}$, where $f : M \to M$ prescribes the uncoupled evolution law on the phase space M. Suppose that these dynamical systems interact additively, and the interaction is prescribed by a a coupling function $h : M \times M \to \mathbb{R}$ and a graph where each node represents one of the systems, and the presence of an edge connecting two of the nodes implies the interaction of the corresponding systems via the coupling function.

I here consider the case where: f is a chaotic expanding map; the network is heterogeneous, meaning that the graph is made of nodes which are very well connected to the others (hubs), and nodes which are poorly connected (low degree nodes); the interaction between two nodes is weak in the sense that decreases with the size of the network. In this case, the systems scoped by numerical simulation seem to reveal that low degree nodes tend to evolve close to their uncoupled dynamics while the hubs feel a mean influence from the other nodes. I will show a rigorous result proving that, under certain hypotheses, this is the case for a large set of initial conditions and for a period of time exponentially long with the size of the network. The result is then used to give a possible explanation to some synchronisation phenomena in the evolution of dynamics on networks.

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