

## Deciphering the Transport in complex systems

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*Abstract:* In the past few years have studied the topological structure of static and evolving complex networks. In more recent times, researchers have become interested in analyzing the network as a dynamical system on which there is a dynamical quantity that varies in time, or where packets are transported across the network. We discuss examples of transport over complex networks that can involve the generation of spontaneous magnetization or nontrivial topological phase transitions in magnetic systems; the propagation of electric or spin currents, quantum information, photons; the evolution of stress dissipation in active geophysical regions; transport of vehicles in cities or packets in communication networks, etc. We also present recent simulation and analytical results on the transport of a classical quantity in a generalization of the “Ehrenfest urn” over complex networks. Concepts of interest include the characterization of the asymptotic dynamical equilibrium state, the distribution of time scales, the approach to the dynamical equilibrium state, and the fluctuations distribution at equilibrium, etc. These concepts are analyzed for a number of nontrivial complex networks, such as the so-called scale-free and small-world networks. These results provide intuition about the transport and nontrivial dynamics that occur in the systems discussed above.

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