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DYNAMICS ON COMPLEX NETWORKS: MODELING THE FORM TO SHAPE THE SUBSTANCE

A PUBLIC TALK BY

GIULIA CENCETTI

PhD Candidate, Information Engineering Department, University of Florence

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ABSTRACT | Multidimensional systems coupled via complex networks are widespread in nature and thus frequently invoked for a large plethora of interesting applications. In models of random walk or diffusion, graph theory results fundamental to describe the disordered support where the dynamics take place as a discrete set of local sites visited by agents. In this framework, a model is presented where positioning traps on strategic nodes of a network allow to capture the random walkers and redirect the mobility flux, with applications on urban flow and web surfing. Moving then to reaction-diffusion models the focus is put on the possible structural modifications of a network (at the topological level) shaped to drive the system towards a particular, a priori chosen, dynamical behavior. The control is performed, when possible, caring about the minimality of the modifications in order to make them applicable to a real system, like for instance neuronal oscillators. Network theory can also provide the backbone of couplings when the system is composed by individual entities which, grouped in families, are schematized by mutually interacting vertices; in this context models of ecosystems stability analysis are examined. A recent work on network measurements like centrality and degree correlations is also discussed.

BIO | Giulia Cencetti is a PhD student at the University of Florence. Her interdisciplinary background (one year studying biology, then Bachelor's and Master's Degree in physics and now a PhD in Information Engineering) took her to work on complex systems and in particular on the fascinating branch of dynamical systems on complex networks. She developed different models to explore the impact of network topology on the dynamical behavior of a system, having as an ultimate goal to apply a strategic external control. Applications are in biology, ecosystems stability, urban traffic, and information flow.