Analysis of Complex Networks: Structure and Dynamics

Politecnico di Milano, **February 20 - 22, 2013**

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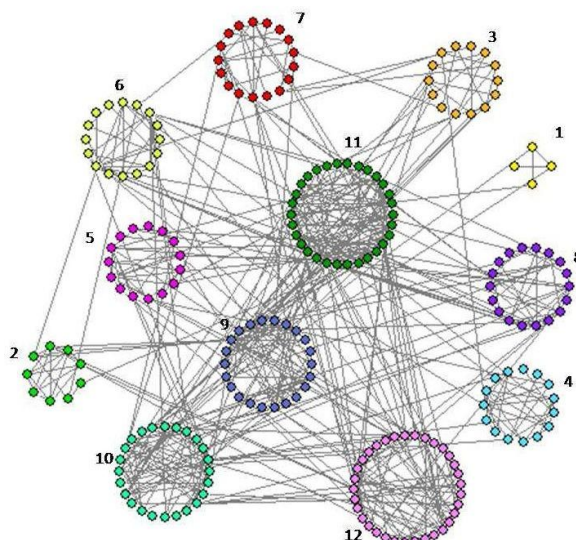
Scientific course organised by

**DEI - Department of Electronics, Information
and Bioengineering
Politecnico di Milano**

SICC - Italian Society for Chaos and Complexity

A **network** is a set of **agents** pairwise connected by **links**. Despite the simplicity of this definition, the theoretical properties of networks are extremely rich and diversified. Most notably, networks turn out to be extremely flexible in modeling a wide variety of phenomena characterized by a large number of interconnected elementary units: **social networks**, **the Internet and the WWW**, **sensor networks**, **ecological communities**, **biochemical systems**, **energy transportation networks**, **economic and financial networks**, are just but a few examples.

The course is part of the teaching activities organized by the PhD Program in Information Technology at Politecnico di Milano, yet it is not only addressed to PhD students, but to all researchers working in any areas of science and engineering and interested in the theory and applications of **complex networks**. The aim is to illustrate the fundamental theoretical notions as well as a number of **applications** in specific fields. The basic definitions, a few useful indicators, and the most important network models are first introduced (**"structure"**). Then, dynamical systems interacting through the network will be considered, to illustrate how phenomena such as epidemic/information diffusion or large-scale consensus and synchronization can be dealt with (**"dynamics"**).

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PROGRAM

- Networks and their topology. Distance, diameter, clustering coefficient, degree distribution, measures of centrality. Network models: random, small-world, scale-free. Community analysis
- The PageRank computation in Google, randomized algorithms, web aggregation and consensus of multi-agent systems
- The international-trade network: empirical evidence and modeling
- Networks in the brain
- Contact processes on networks: dynamics of epidemic diseases
- Networks of dynamical systems and collective behaviors
- Emergence of spatial patterns and Turing instability
- Master-slave synchronization
- Master Stability Function approach
- Connection Graph Stability method
- Topological indicators of synchronization propensity
- Evolution of biological networks toward synchrony and chaos
- Adaptation and evolution for synchronization and control of complex networks
- Consensus-based distributed estimation in sensor networks

For information and application, visit

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