**Title: The transition to synchronization of networked systems**

**Author:** Stefano Boccaletti

**Affiliation:** CNR - Institute of Complex Systems, Via Madonna del Piano 10, I-50019 Sesto Fiorentino, Italy

**Abstract:** I will show that the transition to synchronization of a generic networked dynamical system is a feature that only depends on the topology of the network's connections and can be entirely predicted and completely characterized with the only help of eigenvalues and eigenvectors of the graph's Laplacian matrix. In particular, the transition is made of a well-defined sequence of events, each of which corresponds to either the nucleation of one (or several) cluster(s) of synchronized nodes or to the merging of multiple synchronized clusters into a single one. The network's nodes involved in each of such clusters can be exactly identified, and the value of the coupling strength at which such events are taking place (and therefore, the complete events' sequence) can be rigorously ascertained. I will moreover clarify that the synchronized clusters are formed by those nodes which are indistinguishable at the eyes of any other network's vertex, and as so they receive the same dynamical input from the rest of the network. Therefore, such clusters are more general subsets of nodes than those defined by the graph's symmetry orbits, and at the same time more specific than those described by network's equitable partitions. Finally, I will present large-scale simulations which show how accurate are our predictions in describing the synchronization transition of both synthetic and real-world large size networks, and we even report that the observed sequence of clusters is preserved in heterogeneous networks made of slightly non-identical systems.

**Keywords**: Synchronization; Complex Networks; Phase transition.

**Author Profile:**

Scholar profile: https://scholar.google.com/citations?user=BEC76f4AAAAJ&hl=it&oi=ao