Statisztikus Fizika Szemináriumok

2019. szeptember 25.
szerda, 11.00
ELTE TTK Északi Tömb 2.54

Ulrike Feudel

Transient chaos in networked systems: Desynchronization and state-dependent vulnerability

We analyze the final state sensitivity of nonlocal networks of Duffing oscillators with respect to the initial conditions of their units. By changing the initial conditions of a single network unit, we perturb an initially synchronized state, which is the only attractor for a single unit. Depending on the perturbation strength, we observe the existence of two possible network long-term states: (i) The network neutralizes the perturbation effects and returns to its synchronized configuration. (ii) The perturbation leads the network to an alternative desynchronized state. By computing uncertainty exponents of a two-dimensional cross section of the state space, we find the existence of a fractal set of initial conditions converging to this desynchronized solution, which appears to be either a new attractor or a chaotic saddle, i.e. an unstable chaotic set on which trajectories persist for extremely long times. Furthermore, we report the existence of an intricate time dependence of the vulnerability of the synchronized states in a network composed of identical electronic circuits. By perturbing the synchronized dynamics in consecutive instants of time, we find that synchronization breaks down for some time instants while it persists for others. The mechanism behind this intriguing phenomenon is again the existence of an unstable chaotic set close to the synchronized trajectory. Both phenomena highlight the crucial role played by unstable chaotic set leading to transient chaotic dynamics in networked systems. We discuss that these phenomena are generic for large classes of nonlinear dynamical systems.

1117. Budapest, Pázmány Péter sétány 1/A (Északi tömb)
2.54-es szoba
http://glu.elte.hu/~statfiz/index.html
https://www.kfki.hu/ elftrfsz/szem.html