MS Problems when inferring networks from data (MS08)
7 September 16.30–18.30 (PCC 2.1-2.3)

Time: 16.30 – 16.55

Tracing the temporal evolution of coherence in networks of nonlocally coupled oscillators

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Abstract: We use a data-driven approach to study the dynamics of a ring of identical phase oscillators with nonlocal coupling. Such networks can segregate into two opposing subpopulations, one with simple harmonic and mutually synchronous oscillations and the other with an irregular asynchronous motion. Accordingly, the symmetry of the network architecture is broken by the network's dynamics - a so-called chimera state is formed. While chimera states are stable in the thermodynamic limit of infinitely many oscillators [3], they can collapse after long lifetimes to a fully synchronized state for networks of finite size. We at first study the influence of the shape and broadness of the coupling kernel function on the dynamics. Features that are investigated include the probability that a chimera state is formed after initializing the network with random phases and the mean lifetime of chimera states once they are formed. We then set the coupling kernel such that chimera states are formed for approximately 95% of the realizations and the mean lifetimes are comparable to maximal lifetimes reported in previous studies [4, 5]. Finally, we study the temporal evolution of the local order parameter derived from the phases of the oscillators [1]. We show how the information extracted from this order parameter can be used to provoke or counteract the collapse of chimera states to the fully synchronized state using a control scheme similar to the one proposed in [4]. Accordingly, we show how data measured from a network of phase oscillators can be used to not only infer the current state of the network but also to control its dynamics.
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