

Order-parameter analysis of collective dynamics in networks of oscillators

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Abstract: Collective behaviors of networks of oscillators have attracted much attention in recent years. The synchronization among populations of oscillators represent a typical collective behavior. In the present talk, we give a retrospect of recent developments of synchronizations in networks of oscillators from the microscopic level to the macroscopic level. In the microscopic level, synchronization among oscillators can be well exhibited in terms of the synchronization tree, where the process from partial synchrony to global synchrony is accompanied by the reduction of phase-space dimension. This supports a macroscopic approach of collective synchronization in terms of order-parameter dynamics. The dynamics of high-dimensional space can be reduced to a low-dimensional subspace in terms of the order-parameter approach. The order-parameter equation enables us to grasp the essential low-dimensional dynamical mechanism of the synchronization for complex networks. Different solutions of the order-parameter equation correspond to diverse collective states, and different bifurcations reveal various transitions among these collective states.

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