Angular Frequency Synchronization and Localized Dynamics in Symmetrically Coupled Oscillators

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Abstract

The emergence of collective behavior is a fascinating feature of interacting oscillatory units in nature and technology. Apart from full synchronization, solutions where a localized subset of oscillators are synchronized have attracted an enormous amount of attention recently. Weak chimerasoriginally defined for networks of phase oscillators where the state of each oscillator is given by a single phase-like variableprovide a rigorous notion to describe such dynamics in terms of frequency synchronization along trajectories. We extend the definition to more general classes of oscillators by relating frequency synchronization to the symmetry properties of the system. Moreover, we discuss some persistence results for weak chimeras in coupled phase oscillators. In particular, we explicitly give coupling functions which give rise to chaotic weak chimeras for which the underlying dynamically invariant sets have trivial or nontrivial symmetries.