Nonlinear Sciences > Chaotic Dynamics

# Spatiotemporal phase synchronization in a large array of convective oscillators

M. A. Miranda, J. Burguete

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In a quasi-1D thermal convective system consisting of a large array of nonlinearly coupled oscillators, clustering is the way to achieve a regime of mostly antiphase synchronized oscillators. This regime is characterized by a spatiotemporal doubling of traveling modes. As the dynamics is explored beyond a spatiotemporal chaos regime with weak coupling, new interacting modes emerge through a supercritical bifurcation. In this new regime, the system exhibits coherent subsystems of antiphase synchronized oscillators, which are stationary clusters following a spatiotemporal beating phenomena. This regime is the result of a stronger coupling. We show from a phase mismatch model applied to each oscillator, that these phase coherent domains undergo a global phase instability meanwhile the interactions between oscillators become nonlocal. For each value of the control parameter we find out the time-varying topology (link matrix) from the contact interactions between oscillators. The new characteristic spatiotemporal scales are extracted from the antiphase correlations at the time intervals defined by the link matrix. The interpretation of these experimental results contributes to widen the understanding of other complex systems exhibiting similar phase chaotic dynamics in 2D and 3D.

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