Condensed Matter > Statistical Mechanics

Synchronization of oscillators with long range power law interactions

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We present analytical calculations and numerical simulations for the synchronization of oscillators interacting via a long range power law interaction on a one dimensional lattice. We have identified the critical value of the power law exponent α_c across which a transition from a synchronized to an unsynchronized state takes place for a sufficiently strong but finite coupling strength in the large system limit. We find $\alpha_c=3/2$. Frequency entrainment and phase ordering are discussed as a function of $\alpha \geq 1$. The calculations are performed using an expansion about the aligned phase state (spin-wave approximation) and a coarse graining approach. We also generalize the spin-wave results to the {\it d}-dimensional problem.

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