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Synchronization on Complex Networks

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The synchronization transition of coupled random frequency oscillators is revisited. The Kuramoto model on a complete graph is known to exhibit a mean-field-type continuous phase transition in both phase and frequency synchronization with a unimodal symmetric distribution of intrinsic frequencies. We consider the Kuramoto model on complex networks such as Erdos-Renyi random networks and scale-free networks, where quenched disorder in connectivity is present in addition to quenched disorder in intrinsic oscillator frequencies. We find that frequency disorder fluctuation induces anomalous finite-size-scaling behaviour near the onset of the synchronization. More interestingly, connectivity disorder fluctuation changes the nature of the synchronization transitions, when the random frequency distribution takes a flat or a bimodal shape.

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