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Discordant synchronization of noisy oscillators with asymmetric give-and-take

Abstract:

We discuss the collective dynamics in two populations of noisy oscillators with asymmetric interactions. As an illustrative example we focus on Kuramoto phase oscillators that have the same natural frequency, but differ in their perception of the mean field and their contribution to it. Such a give-and-take mechanism is given by asymmetric in- and out-couplings which can also be positive (attractive) and negative (repulsive). We uncover in this minimal network of networks intriguing patterns of discordance, where the ensemble splits into two clusters separated by a constant phase lag. If the lag differs from π , then traveling wave solutions emerge. We report a second route to traveling waves via traditional one-cluster states. Bistability is found between the various collective states. Analytical results and bifurcation diagrams are derived with the help of a reduced system.