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Distributed Time Delay and Synchronization in a Neural Mass Model

We consider a neural field model for a brain network which is a network of Wilson-Cowan nodes with homeostatic adjustment of the inhibitory coupling strength and time delayed, excitatory coupling. Without time delay, the system has been shown to exhibit rich dynamics including oscillations, mixed-mode oscillations, and chaos. We show how synchronization of the nodes depends on both the connectivity structure of the network and the attributes of the distribution of time delays in the connections between nodes. We show that Hopf bifurcations induced by the excitatory coupling, the connectivity structure and the delay lead to different patterns of phase-locked oscillations, either synchronized or desynchronized. Finally, we study how the mean and variance of the distribution affect the results.