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System dynamics of non-diffusively coupled oscillators LAUREN LAZARUS[1], University of New Hampshire, JOSEPH TRANQUILLO[2], Bucknell University — Many physical systems are composed of multiple oscillators which when coupled tend to synchronize. In many systems, coupling is assumed to be bidirectional and diffusive, which in phase space acts to strongly attract limit cycles to one another. Our simulations explore the impact of other forms of coupling, such as synaptic, phase and transient coupling which also occur in physical systems and can have a profound impact on system dynamics. For example, when we transformed two unit oscillator into Cartesian coordinates and coupled only one state variable, the limit cycles collapsed to equilibrium points. We have also found bifurcation routes to and from limit cycles when the FitzHugh-Nagumo and Hindmarsh-Rose neuron models were coupled via unidirectional synapses which do not occur when the cells are coupled diffusively. The underlying reason for these differences is that non-diffusive coupling may be alternately attractive and repulsive at various phases of the limit cycles. These results suggest that the type of coupling can be just as important in determining system behavior as the dynamics of the individual oscillators.

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