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Analytical connections between nonlinear coupled oscillator models.

Systems of nonlinear differential equations have been used extensively to model a variety of neurological and biomechanical nonlinear oscillators. One commonly used system is the Haken-Kelso-Bunz (HKB) model for biomechanical systems with multiple components. The FitzHugh-Nagumo (FN) system is a simplification of the Hodgkin-Huxley model of a single nerve axon. The HKB models an oscillator with nonlinear damping combining terms from Van der Pol and Rayleigh equations. Following Leise and Cohen, we find that for suitable choices of parameters, HKB models the behavior of oscillating fingertips with periodic solutions with an amplitude inversely proportional to oscillation frequency. The HKB model can be analytically decomposed into a first-order system of the form of FN. Comparing nullclines and numerical solutions of the HKB fingertip model shows similarities to the much simpler FN oscillator. The implications of this connection for interactions between coupled oscillators are explored. (Received September 12, 2007)