Dynamical system approach to synchronization of the coupled Schrödinger–Lohe system

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We study wave function synchronization of the Schrödinger–Lohe model, which describes the dynamics of the ensemble of coupled quantum Lohe oscillators with infinite states. To do this, we first derive a coupled system of ordinary differential equations for the L_x^2 inner products between distinct wave functions. For the same one-body potentials, we show that the inner products converge to unity for some restricted class of initial data, so complete wave function synchronization emerges asymptotically when the dynamical system approach is used. Moreover, for the family of one-body potentials consisting of real translations of the same base potential, we show that the inner products for a two-oscillator system follow the motion of harmonic oscillators in a small coupling regime, and then as the coupling strength increases, the inner products converge to constant values; this behavior yields convergence toward constant values for the L_x^2 differences between distinct wave functions.