Abstract

Realization of logic gates in both single nonlinear systems and coupled nonlinear oscillators

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The implementation of logic gates has been widely investigated in nonlinear dynamical systems from various perspectives over the years. Specifically, logic gates have been realized in both single nonlinear systems and coupled nonlinear oscillators. Most of the studies in the literature have focused on transforming single oscillators into OR/AND or NOR/NAND logic gates. In the present study, we demonstrate the design of logic gates in coupled double-well Duffing oscillators by applying two logic inputs to the drive system, along with a fixed bias. The nonlinear system, which comprises bi-directional components, exhibits varied logic behaviors within an optimal range of coupling strength. Both attractive and repulsive couplings lead to similar yet complementary logic behaviors in the first and second oscillators. These couplings play a crucial role in the realization of fundamental and universal logic gates in simple nonlinear systems.

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