Nonlinear dynamics of two coupled nano-electromechanical resonators

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As a model of coupled nano-electromechanical resonantors we study two nonlinear driven oscillators with an arbitrary coupling strength between them. Analytical expressions are derived for the oscillation amplitudes as a function of the driving frequency and for the energy transfer rate between the two oscillators. The nonlinear restoring forces induce the expected nonlinear resonance structures in the amplitude-frequency characteristics with asymmetric resonance peaks. The corresponding multistable behavior is shown to be an efficient tool to control the energy transfer arising from the sensitive response to small changes in the driving frequency. Our results imply that the nonlinear response can be exploited to design precise sensors for mass or force detection experiments based on nano-electromechanical resonators.

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