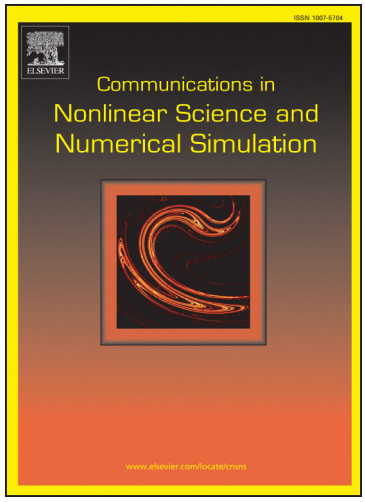

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Design considerations on large amplitude vibration of a doubly clamped microresonator with two symmetrically located electrodes

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Abstract

In this paper, a doubly clamped microresonator with two symmetrically located electrodes is investigated to provide some design considerations on large amplitude vibration of this type of micro-electro-mechanical system (MEMS). The equilibrium points of the corresponding Hamiltonian system are determined at first. From the viewpoint of energy, large amplitude vibration and dynamic pull-in phenomenon are explained quantitatively according to the energy of potential barrier/ well or the homoclinic/ heteroclinic orbits, and the corresponding parameter regions are derived. Then, first mode assumption with classical beam theory is introduced to study the effect of physical parameters on the vibration of the resonator. Some design regions are theoretically obtained and then numerically verified. To avoid complicated vibration and obtain better performance, Melnikov method is applied to predict the existence of chaos. Besides, numerical simulation is carried out to find the stable regions by using bifurcation diagrams with local maximum method. Furthermore, four possible physical devices are designed to examine the effectiveness of the simulation approach.

Key words: MEMS; Doubly clamped resonator; Large amplitude; Nonlinear dynamics

1. Introduction

In recent years, micro-electro-mechanical systems (MEMS) have become one of the most

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