The nonlinear vibration of curved micro beams under axial and electrostatic forces

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Abstract

The aim of this paper is to show the nonlinear dynamical behaviors of the curved micro beam under axial and electrostatic forces. By using the reduced-order model and the multiscale method, the amplitude-frequency characteristic curves of the nonlinear vibration are exhibited in the literature. Moreover, the variations of the natural frequency under axial forces ranging from compressive loads to tensile loads and voltage loads from small values to large values near the pull-in instability are discussed in detail. It is also shown that axial forces can efficiently tune the frequency of micro beam in a very large range, which may be considered as a beneficial feature in many applications. These research results in the paper can provide a reasonable explanation for the experimental phenomena of micro sensors and are beneficial to the optimization design of the electrostatic microelectronic mechanical system（MEMS）.

Keywords: Multiscale method; Amplitude-frequency curves; Pull-in instability; Axial forces; Electrostatic forces