15th INTERNATIONAL CONFERENCE
Dynamical Systems — Theory and Applications
December 2-5, 2019. Lodz, POLAND.

DSTA 2019

paper id: VIB255

Dynamics of the microresonator in the regime of supercritical compression

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Abstract: In this work we research microresonator consisting of an elastic element in the form of a beam located between stationary electrodes. One end of the beam is rigidly clamped, and the other one is elastically fixed in the longitudinal direction. Longitudinal movement of the elastic fastening creates a longitudinal force in the elastic element of the microresonator. Equilibrium positions depending on the longitudinal displacement of the elastic fastening mechanism are obtained in the presence of a longitudinal compressive force and one or two sources of constant electromotive force. With different switched on sources of constant electromotive force either two or three critical values of the force are possible, which differ from the Euler force. In the formulation of free oscillations phase portraits of the system were constructed for various field inclusions. The forced oscillations of the resonator with supercritical longitudinal compressive loads in different regimes are considered. Resonance curves were constructed with characteristic jump phenomena during the transition from one regime to another. A comparison of the results of the multi-scale solution with the numerical integration in the MATCONT software package has been carried out. A positive feedback scheme for the excitation of self-oscillatory modes was proposed. A numerical experiment demonstrating the possibility of the occurrence of a self-oscillatory regime was carried out and the effect of various parameters on the frequency and amplitude of self-oscillations was investigated.

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