

عنوان مقاله:

A study on the use of perturbation technique for analyzing the nonlinear forced response of piezoelectric microcantilevers

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نویسندگان:

m Zamanian - *Department of Mechanical Engineering, Faculty of Engineering, Kharazmi University, P.O. Box 15719-14911, Tehran, Iran*

m Hadilu - *Department of Mechanical Engineering, Faculty of Engineering, Kharazmi University, P.O. Box 15719-14911, Tehran, Iran*

b Firouzi - *Department of Mechanical Engineering, Faculty of Engineering, Kharazmi University, P.O. Box 15719-14911, Tehran, Iran*

خلاصه مقاله:

In this paper, a comparison is made between direct and indirect perturbation approaches to solve the non-linear vibration equations of a piezoelectrically actuated cantilever microbeam. In this comparison, the equation of motion is considered according to Euler-Bernoulli theory with considering the non-linear geometric and inertia terms resulted from shortening effect. In the direct perturbation approach, the multiple scales method is directly applied to the partial differential equation of motion. In the indirect approach, the multiple scales perturbation technique is applied to the discretized equation of motion. It is shown that, if the equation of motion is discretized using one non-uniform microbeam mode shape as a comparison function, then the results of indirect perturbation approach will be identical to those of the direct perturbation approach. Moreover, it is observed that discretization using one uniform microbeam mode shape as a comparison function results in a different output. The concept of non-uniform microbeam mode shape is the linear mode shape of the microbeam by considering the geometric and inertia effects of the piezoelectric layer.

کلمات کلیدی:

Direct perturbation, Indirect perturbation, Microcantilever, Nonlinear vibration, Shortening effect, Piezoelectric

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