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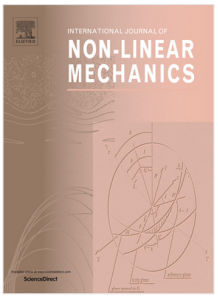

Global bifurcations and chaotic motions of a flexible multi-beam structure

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Global bifurcations and chaotic motions of a flexible multi-beam structure

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Abstract Global bifurcations and multi-pulse chaotic motions of flexible multi-beam structures derived from an L-shaped beam resting on a vibrating base are investigated considering one to two internal resonance and principal resonance. Base on the exact modal functions and the orthogonality conditions of global modes, the PDEs of the structure including both nonlinear coupling and nonlinear inertia are discretized into a set of coupled autoparametric ODEs by using Galerkin's technique. The method of multiple scales is applied to yield a set of autonomous equations of the first order approximations to the response of the dynamical system. A generalized Melnikov method is used to study global dynamics for the "resonance case". The present analysis indicates multi-pulse chaotic motions result from the existence of Šilnikov's type of homoclinic orbits and the critical parameter surface under which the system may exhibit chaos in the sense of Smale horseshoes are obtained. The global results are finally interpreted in terms of the physical motion of such flexible multi-beam structure and the dynamical mechanism on chaotic pattern conversion between the localized mode and the coupled mode are revealed.

Keywords: Flexible multi-beam structures; Autoparametric system; Global dynamics; Melnikov method; Localized mode; Coupled mode

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