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Nonlinear Dynamics
Volume 61, Issue 1-2, July 2010, Pages 163-182

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Internal-external resonance of beams on non-linear viscoelastic foundation traversed by moving load

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Abstract

Vibration of a finite Euler-Bernoulli beam, supported by non-linear viscoelastic foundation traversed by a moving load, is studied and the Galerkin method is used to discretize the non-linear partial differential equation of motion. Subsequently, the solution is obtained for different harmonics using the Multiple Scales Method (MSM) as one of the perturbation techniques. Free vibration of a beam on non-linear foundation is investigated and the effects of damping and non-linear stiffness of the foundation on the responses are examined. Internal-external resonance condition is then stated and the frequency responses of different harmonics are obtained by MSM. Different conditions of the external resonance are studied and a parametric study is carried out for each case. The effects of damping and non-linear stiffness of the foundation as well as the magnitude of the moving load on the frequency responses are investigated. Finally, a thorough local stability analysis is performed on the system. © 2010 Springer Science+Business Media B.V.

Language of original document

English

Author keywords

Galerkin method; Moving load; Multiple scales method; Non-linear vibration; Perturbation method; Viscoelastic foundation

Index Keywords

Moving load; Multiple scales methods; Non-linear vibrations; Perturbation method; Viscoelastic foundation
Engineering controlled terms: Damping; Degrees of freedom (mechanics); Equations of motion; Foundations; Frequency response; Galerkin methods; Resonance; Stiffness
Engineering main heading: Perturbation techniques

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