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Frequency analysis of strongly nonlinear generalized Duffing oscillators using He's frequency-amplitude formulation and He's energy balance method

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Abstract

In this paper, He's Frequency-Amplitude Formulation (HFAF) and He's Energy Balance Method (HEBM) are employed to solve the generalized Duffing equation in the form of over $(x, \dot{x}) + x + \alpha_3 x^3 + \alpha_5 x^5 + \alpha_7 x^7 + \dots + \alpha_n x^n = 0$. For any arbitrary power of n , a frequency analysis is carried out and the relationship between the natural frequency and the initial amplitude is obtained in analytical form. Accuracy and validity of the proposed techniques are then verified by comparing the numerical results obtained based on the HFAF, HEBM and exact integration method. Numerical simulations are extended for even very strong nonlinearities and very good correlations are achieved between the numerical results. © 2010 Elsevier Ltd. All rights reserved.

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Engineering controlled terms: Computer simulation; Control nonlinearities; Energy balance; Numerical analysis
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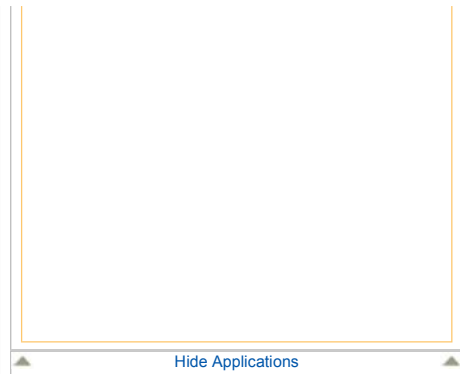
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