Bifurcations Of Approximate Harmonic Balance Solutions And Transition To Chaos In An Oscillator With Inertial And Elastic Symmetric Nonlinearities

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Summary

The local stability of approximate periodic solutions and period-doubling bifurcations in a harmonically forced non-linear oscillator with symmetric elastic and inertia non-linearities are studied analytically and numerically. Approximate principal resonance solutions are first obtained using a two-term harmonic balance and then a consistent second order stability analysis of the associated linearized variational equation is carried out using approximate methods to predict zones of symmetry breaking leading to period-doubling bifurcation and chaos. The results of the present work, which follows the analysis approach presented by Szemplinska-Stupnika (1986 International Journal of Nonlinear Mechanics 23, 257-277; 1987 Journal of Sound and Vibration 113, 155-172) are verified for selected system parameters by numerical simulations using methods of qualitative theory, and good agreement was obtained between the analytical and numerical results. Finally, a criterion for the period-doubling bifurcation is proposed analytically, for this type of oscillator, and compared with computer simulation results that predict the true period-doubling bifurcation and chaos boundaries. (C) 2001 Academic Press.

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