УНИВЕРЗИТЕТ У НОВОМ САДУ
UNIVERSITY OF NOVI SAD

TOP ACHIEVEMENTS 2022

FACULTY OF TECHNICAL SCIENCES

Published work in an international journal of exceptional value: M. Bayat, L. Cveticanin, Nonlinear analysis of two-degree of freedom system with nonlinear springs, Mechanical Systems and Signal Processing, 171, 108891, 2022, pages 11 (M21a)

Mechanical systems and signal processing

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In this paper, an analytic solving procedure for a two degree of freedom oscillatory system is considered. Vibration of the two-mass system is mathematically modeled with two coupled second-order equations. The system is assumed to be strongly nonlinear, and a high order Homotopy Perturbation Method (HPM) for solving the system is developed. The frequency of vibration is obtained in the second approximation. To validate the method, two examples are considered. The solutions of the HPM are compared with those of Newton–harmonic balance (NHB) and numerical approaches. It has been demonstrated that HPM leads to a highly accurate solution even with the first iteration of the solution and is valid for a wide range of vibration amplitudes, showing promise as a means to provide an exact or closed-form solution of nonlinear dynamical systems, as indicated in the following examples. Following conclusions are derived: The HPM is suitable for frequency calculation of the two degrees of freedom system. The method is applicable even for the system with strong nonlinearity. The accuracy of the first order HPM approximate solution is very high and the frequency error in comparison to the exact solution is smaller than 0.03%. The procedure for determination of the second order HPM approximate solution is quite simple but gives highly accurate results. Frequency of vibration depends on the initial amplitude of vibration. The higher the value of the initial amplitude, the higher the value of the frequency. However, if the nonlinearity is quite small, the effect of amplitude is negligible. Frequency of vibration depends on the coefficient of nonlinearity. For certain values of amplitude, the frequency is higher for higher values of the coefficient on nonlinearity.