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Journal of Interdisciplinary Mathematics
Volume 23, Issue 7, 2 October 2020, Pages 1325-1345

A modified harmonic balance method to obtain higher-order approximations to strongly nonlinear oscillators (Article)

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Abstract

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We propose a new method, namely, the modified harmonic balance method. This paper also analyses and offers the high-order approximate periodic solutions to the strongly nonlinear oscillator with cubic and harmonic restoring force. The existing harmonic balance method cannot be applied directly to such kind of nonlinear oscillators in the presence of forcing term. It is possible if we rewrite the original form of the nonlinear oscillators. If we do so, the results are valid only for small values of amplitude of the oscillation. Moreover, after applying the existing harmonic balance method, a set of complicated higher-order nonlinear algebraic equations are obtained. Analytical investigation of these equations is cumbersome especially when the amplitude of the oscillation is large. These limitations are removed in the proposed method. In addition, a suitable truncation principle has also been used in which the solution achieves better results than existing solutions. The approximate results agree well with numerically obtained exact solutions. Highly accurate results and a simple solution procedure are the advantages of this proposed method, which could be applied to other nonlinear oscillatory problems arising in nonlinear science and engineering. © 2020 Taru Publications.

SciVal Topic Prominence ⓘ

Topic: Nonlinear Oscillator | Harmonic Balance | Homotopy Perturbation Method

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Author keywords

34A34 34A45 34B15 34C15 34G20 Approximate solutions Cubic and harmonic restoring force oscillator
Harmonic balance method Homotopy perturbation method Iteration method

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