# A modified harmonic balance method to obtain higher-order approximations to strongly nonlinear oscillators

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## Abstract

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.

## Keywords

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