



A Simple Analytical Technique to Investigate Nonlinear Oscillations of an Elastic Two Degrees of Freedom Pendulum

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Abstract: Based on the general Struble's technique, a simple analytical technique has been presented to investigate nonlinear oscillations of an elastic pendulum. The method is illustrated by swinging spring pendulum in the resonance cases (frequencies ratio is equal to 1 : 2). Solutions not only show a good coincidence with the corresponding numerical solution but also give better result than multiple scales (MS) method.

Keywords: *nonlinear oscillation; swinging spring pendulum; Struble's technique.*

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1 Introduction

Struble's technique [1], Krylov-Bogoliubov-Mitropolskii (KBM) method [2, 3], multiple time-scales method [4] are usually applied to determine the approximation solutions of weakly nonlinear differential equations. Popov [5] extended the KBM method to a damped system. Bojadziev [6] studied second order nonlinear system with strong damping effect by the two time scales method and justified that the solution is similar to that obtained by Popov [5]. Sometimes, all classical perturbation techniques [1–3] are useless to solve some nonlinear differential equations. In this regard, Shamsul [7] presented a general Struble's techniques to determine approximate solution of n -th order weakly non-linear differential systems. It is easy to apply the general Struble's technique to solve nonlinear differential equations with various damping effect.

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