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Editorial

Advances in Nonlinear Vibration

Livija Cveticanin,[1] Kale Oyedeji,[2] Vasile Marinca,[3] and Nicolae Herisanu[4]

[1] *Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovica 6, 21000 Novi Sad, Serbia*
[2] *Department of Physics, Morehouse College, Atlanta, GA, USA*
[3] *Center for Advanced and Fundamental Technical Research, Romanian Academy, Timişoara Branch, Bulevardul Mihai Viteazu, 24, 300223 Timişoara, Romania*
[4] *Politehnica University of Timisoara, Bulevardul Mihai Viteazu, 1, 300222 Timişoara, Romania*

Correspondence should be addressed to Livija Cveticanin; cveticanin@uns.ac.rs

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1. Introduction

The main subject of the topic is nonlinear vibration and the oscillatory motion of the strong nonlinear system in all its varied aspects, including truly nonlinear oscillator, oscillator with time variable parameter, forced vibration, parametrical vibration, and analytical solving methods for these dynamic systems.

In this issue, 1 review and 8 original research papers are published. The papers analyze the oscillatory motion and vibration of the strong nonlinear oscillatory systems which appear and are applied in all the fields of science and engineering. The topics of the papers are

(i) strong nonlinear oscillatory systems (2 papers);

(ii) asymptotic methods in truly nonlinear oscillators (2 papers);

(iii) forced vibrations in the multiple-degree-of-freedom oscillatory system (1 paper);

(iv) application of the asymptotic methods in biomechanical (1 paper) solid structures (1 paper);

(v) nonlinear phenomena in stability and vibration of an elastic body (2 papers).

We are going to introduce the selected papers in the categories of nonlinear vibrations of a cubic-quintic Duffing oscillator, a biomechanical system, a truly nonlinear oscillator with its application to an electrical machine, multiple-degree-of-freedom oscillator and multibody system, and elastic body (sandwich beam and cylinder).

2. Analytical Solution Procedures for the Cubic-Quintic Duffing Oscillator

In the paper entitled *"Analytical approximate solutions for the cubic-quintic Duffing oscillator in terms of elementary functions,"* A. Beléndez et al. present a procedure for solving the cubic-quintic Duffing oscillator. The method is based on the expansion of the restoring force into the Chebyshev polynomials and transformation of the original nonlinear differential equation into a cubic Duffing one. Approximate solutions are expressed in the form of the complete elliptic integral of the first kind and the cosine Jacobi elliptic function. Using the series expansion of the functions into elementary functions and applying the harmonic balance method, the periodic solution of the original nonlinear oscillator is obtained.

S. Durmaz and M. O. Kaya in their paper entitled *"High-order energy balance method to nonlinear oscillators"* give another analytical procedure for solving the cubic-quintic Duffing oscillator. Namely, the energy balance method developed for high-order nonlinear oscillators is adopted for solving the cubic-quintic Duffing oscillator. The approximation is done up to the third order, and the maximal relative error of the frequency which decreases to 0.008% is analytically solved by applying the energy balance method. There is a