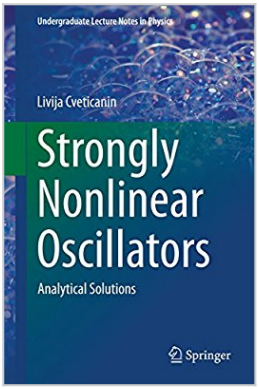

Strongly Nonlinear Oscillators: Analytical Solutions (Undergraduate Lecture Notes in Physics)

By Livija Cveticanin

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This book provides the presentation of the motion of pure nonlinear oscillatory systems and various solution procedures which give the approximate solutions of the strong nonlinear oscillator equations. The book presents the original author’s method for the analytical solution procedure of the pure nonlinear oscillator system. After an introduction, the physical explanation of the pure nonlinearity and of the pure nonlinear oscillator is given. The analytical solution for free and forced vibrations of the one-degree-of-freedom strong nonlinear system with constant and time variable parameter is considered. Special attention is given to the one and two mass oscillatory systems with two-degrees-of-freedom. The criteria for the deterministic chaos in ideal and non-ideal pure nonlinear oscillators are derived analytically. The method for suppressing chaos is developed. Important problems are discussed in didactic exercises. The book is self-consistent and suitable as a textbook for students and also for professionals and engineers who apply these techniques to the field of nonlinear oscillations.

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Editorial Review

Review

From the book reviews:

“This book is devoted to analysis of solutions of the second-order ordinary differential equations (or systems) which describe oscillations of mechanical (and related) systems. … the book can be recommended to engineers as a good source of methods and examples.” (Henryk ?o??dek, Mathematical Reviews, January, 2015)

From the Back Cover

This textbook presents the motion of pure nonlinear oscillatory systems and various solution procedures which give the approximate solutions of the strong nonlinear oscillator equations. It presents the author’s original method for the analytical solution procedure of the pure nonlinear oscillator system. After an introduction, the physical explanation of the pure nonlinearity and of the pure nonlinear oscillator is given. The analytical solution for free and forced vibrations of the one-degree-of-freedom strong nonlinear system with constant and time variable parameters is considered. In this second edition of the book, the number of approximate solving procedures for strong nonlinear oscillators is enlarged and a variety of procedures for solving free strong nonlinear oscillators is suggested. A method for error estimation is also given which is suitable to compare the exact and approximate solutions.

Besides the oscillators with one degree-of-freedom, the one and two mass oscillatory systems with two-degrees-of-freedom and continuous oscillators are considered. The chaos and chaos suppression in ideal and non-ideal mechanical systems is explained.

In this second edition more attention is given to the application of the suggested methodologies and obtained results to some practical problems in physics, mechanics, electronics and biomechanics. Thus, for the oscillator with two degrees-of-freedom, a generalization of the solving procedure is performed. Based on the obtained results, vibrations of the vocal cord are analyzed. In the book the vibration of the axially purely nonlinear rod as a continuous system is investigated. The developed solving procedure and the solutions are applied to discuss the muscle vibration. Vibrations of an optomechanical system are analyzed using the oscillations of an oscillator with odd or even quadratic nonlinearities. The extension of the forced vibrations of the system is realized by introducing the Ateb periodic excitation force which is the series of a trigonometric function.

The book is self-consistent and suitable for researchers and as a textbook for students and also professionals and engineers who apply these techniques to the field of nonlinear oscillations.

About the Author

Livija Cveticanin is Professor of Mechanics and Theory of Machines and Mechanisms. She got her PhD at the University of Novi Sad in Novi Sad, Serbia, and the degree of the Doctor of Hungarian Academy of

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