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Editorial

Nonlinear Vibration of Continuous Systems

Francesco Pellicano,[1] **Matteo Strozzi**,[2] **and Konstantin V. Avramov**[3,4]

[1]*Department of Engineering Enzo Ferrari, University of Modena and Reggio Emilia, Modena, Italy*
[2]*Department of Sciences and Methods for Engineering, University of Modena and Reggio Emilia, Reggio Emilia, Italy*
[3]*Department of Reliability and Dynamic Strength, Podgorny Institute for Mechanical Engineering, National Academy of Science of Ukraine, Kharkov, Ukraine*
[4]*Department of Gas and Fluid Mechanics, National Technical University "KhPI", Kharkov, Ukraine*

Correspondence should be addressed to Francesco Pellicano; francesco.pellicano@unimore.it

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1. Introduction

Continuous systems, such as beams, membranes, plates, shells, and other structural/mechanical components, represent fundamental elements of mechanical systems in any field of engineering: Aerospace, Aeronautics, Automation, Automotive, Civil, Nuclear, Petroleum, and Railways.

The modern designer is required to optimize structural elements to improve the performance-to-cost ratio, produce lightweight machines, and improve the efficiency. Such optimizations easily lead to a magnification of vibration/dynamic problems such as resonances, instabilities, and nonlinear behaviors. Therefore, the development of new methods of analysis, testing, and monitoring is greatly welcome.

This special issue focuses on sharing recent advances and developments of theories, algorithms, and applications that involve the dynamics and vibrations of continuous systems.

The contributions to this special issue include innovative theoretical studies, advanced numerical simulations, and new experimental approaches to investigate and better understand complex dynamic phenomena; more specifically, methods and theories for beams, membranes, plates, and shells; numerical approaches for structural elements; fluid-structure interaction; nonlinear acoustics; identification, diagnosis, friction models, and vehicle dynamics.

Seventeen contributions have been received from all over the world: Canada, China, Kazakhstan, Italy, Macau, Spain, and USA. This shows the generalized interest on the topic.

The following short description of the special issue content is organized by grouping the contributions in coherent subtopics.

2. Nanoscience: Nonlinear Dynamics

M. Strozzi and F. Pellicano present a study on the dynamic properties of nanotubes, a continuous shell model is considered for investigating the interactions of double modes, which are present in nanotubes due to the symmetry. J. Fan and J. Huang develop an approach based on the Haar wavelet discretization method (HWDM) for the nonlinear vibration analysis of carbon nanotube-reinforced composite beams. These two studies represent two different viewpoints in the field of nanoscience, i.e., nanoscale and macroscale analysis.

3. Nonlinear Dynamics: Axially Moving Systems

M. Shao et al. investigate axially moving membranes, focusing the attention to the chaotic response of the system: a deep bifurcation analysis is carried out showing several interesting dynamic behaviors, chaos, quasi-periodicity, and subharmonic response. D. Adair et al. investigate axially moving beams through a new decomposition method: free nonlinear vibrations were analyzed.

4. Modelling

J. Zhao et al. develop a simplified finite element for multilayer plates. E. F. Joubaneh et al. present a generalized differential quadrature approach for sandwich beams.

5. Fluid-Structure Interaction

J. Wang et al. analyze the nonlinear response of a liquid partially filled rigid cylindrical container with a rigid annular

baffle; the study is based on experimental and numerical approaches. M. T. T. Sastre and C. Vanhille analyze the dynamics and resonances of a cavity filled with a nonlinear biphasic medium made of a liquid and gas bubbles.

6. Identification, Nonlinear Time-Series Analysis, Diagnosis, and Structural Integrity

C. Li et al. use the ensemble empirical mode decomposition together with fractal dimension analysis to extract characteristic quantities for fault diagnosis of turbine bearings. P. Fang et al. apply the principle of Poincaré mapping and the periodicity ratio methods for identifying the dynamic characteristics of high-dimensional nonlinear systems. C. Huang et al. present a fault diagnosis method based on the combination of the complete ensemble empirical mode decomposition, periodic segment matrix, and singular value decomposition.

7. Miscellaneous

K. Wang et al. present a study on wagons derailments, in particular the influence factors of derailment during dynamic braking. Z. Li et al. present a paper focusing on identification of road roughness through acceleration measurements. X.-F. Zhong et al. present a paper focusing on active car suspension control. J. Li et al. investigate the nonlinear vibrations of gas journal bearings. A. Hadji and N. Mureithi are concerned with friction models and their validation within finite elements models. J. Li et al. present an analytical model for structural integrity assessment in oil industry applications.

8. Conclusion

We hope that the content of this special issue will be useful to the community of engineers and researchers working on the field of mechanical vibrations.

Conflicts of Interest

The editors declare that they have no conflicts of interest regarding the publication of the special issue.

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Francesco Pellicano
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