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EDITORIAL

Special Issue from WMVC 2022

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This special issue is based on contributions presented at the 10th International Conference on Wave Mechanics and Vibration (10th WMVC), held in Lisbon, Portugal, July 4–6, 2022, jointly organized by the Department of Civil Engineering of the NOVA School of Science and Technology, NOVA University of Lisbon, (DEC/FCT/UNL) and IDMEC, Institute of Mechanical Engineering of the Instituto Superior Técnico of the University of Lisbon (IDMEC/IST/UL).

The WMVC series has its roots in India; it was founded by Prof. Paritosh Biswas as an annual national conference. Due to the pandemic, the 9th edition was cancelled. But the 10th edition was for the first time elevated to an international level.

The Scientific Programme consisted of 4 plenary lectures given in-person, 3 Keynote lectures given remotely, 105 in-person regular presentations and 96 remote ones, grouped according to 25 Mini-Symposia and a General Conference Topic. The conference was attended by 127 in-person and 88 remote participants including 3 keynote speakers. The total number of represented countries was 36.

The main objective of the conference was to bring together academicians, engineers, scientists, researchers, mathematicians and technologists working on wave mechanics and vibration-related problems in various fields of scientific and engineering applications on a common platform. It is believed that the 10th WMVC has had a significant impact on the development of current analytical, numerical and experimental methods in the field of wave mechanics and vibration technology, created an excellent opportunity for university teachers, researchers and industry experts to share new ideas and experiences and provided a forum for discussion and collaboration among participants.

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The following twenty special issue articles, which have been accepted upon the regular and rigorous peer review process of the *Journal of Vibration Engineering and Technologies*, cover various areas of interest in wave mechanics and vibration engineering. They are grouped by Mini-symposia, originally selected by the authors for their research assignment. The Mini-symposia in this issue are ordered from the highest number of current contributions, but then no specific ranking or preference has been applied to the order of the articles.

I gratefully thank the authors for having chosen this special issue to publish their significant research outcomes, which allowed covering the most diverse topics within the scope of the Journal. The voluntary assistance of the reviewers is greatly appreciated as well.

Nonlinear Dynamics and Control of Engineering Systems

Jason Bettega et al. [1] propose a method for optimizing the response of linear vibratory feeders. The aim of this optimization is to achieve the desired motion of the tray with fewer actuators than the degrees of freedom and response specifications would require. The method is exploiting dynamic structural modification and inverse dynamics methods, and its effectiveness is evaluated using numerical simulations.

Mohsen Lalehparvar et al. [2] investigate the effects of actuator and memory delay, start-up time and input constraints on the performance of a delayed-feedback control scheme enabling switching between coexisting impact oscillator attractors, illustrated by two potential applications. One notable observation is that as the delay increases, the settling time follows similar patterns in the two selected case studies.

Mohammad Amin Faghihi et al. [3] propose a model for the coupled axial torsional dynamics of a drill bit with a non-uniform blade arrangement. To capture various phenomena, including multiple regeneration effects, a new method is developed to determine the depth of cut, which is a key component in the estimation of cutting forces. The validity of the proposed

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model is demonstrated by simulation results on a representative case study.

Yue Xu et al. [4] investigate the nonlinear vibration of a twin-spool rotor supported by ball bearings and squeezed film dampers using a reduced-order model obtained by the post-processed nonlinear Galerkin method projecting the original system onto a low-dimensional inertial manifold and selecting the optimal number of master modes. The approach is proven to be effective, efficient and capable of demonstrating the complexity of the rotor dynamics.

Majid Aleyaasin [5] analyzes the possibility of reproducing the Biggs' chart, which is used to determine the ductility ratio of the blast response of structures, using a set of equations. Although an implicit formula for sharp impulses is already available, the error with respect to Biggs' chart predictions is shown to be up to 100%. Therefore, a new surrogate model showing close agreement with Bigg's chart for symmetrical pulses is developed.

Recent Advances in Wave Propagation in Periodic Media and Structures

Elisabetta Manconi et al. [6] study vibration attenuation in radially periodic plates using the Wave Finite Element method to develop a method for predicting the band-gap characteristics in polar coordinates to prevent vibration transmission from the excitation region to the outer region. The results are shown to be in very good agreement with the theoretical and numerical analysis of Floquet theory adapted for wave propagation in radially periodic structures.

In the paper by Moein Abdi et al. [7] the reflection coefficients of an Euler–Bernoulli beam attached to a cubic nonlinear boundary stiffness are analyzed. The reflection coefficients obtained numerically for a series of time-harmonic near-field waves and propagating waves, normalized with respect to the amplitude of the incident propagating wave at the fundamental frequency, have been shown to have a profound effect on the reflection coefficients.

Kristof Steijvers et al. [8] propose injection molding as a method for mass production of metamaterial resonators for vibration mitigation. Incorporating manufacturing simulations into metamaterial performance predictions is shown to improve metamaterial natural frequency as well as band gap predictions, as fabrication-induced geometry and property changes are difficult to implement without it. The benefits are evaluated in three test cases.

Recent Advances in Railway Mechanics and Moving Load Problems

Gianluca Megna and Andrea Bracciali [9] found that the reason why the braking system used on recently modernized metro vehicles affects passengers' comfort with very high low-frequency noise is the resonant behavior caused by the coincidence of the natural frequencies of the wheelset and the brake support. They proposed several structural modifications, which after careful robustness and sensitivity analyses, proved to be effective in solving this problem.

Jian Dai et al. [10] propose a computationally efficient and accurate numerical method for the dynamic response of a maglev train passing on an "infinitely" long multi-span bridge. The vehicle and the guideway are connected through an electromagnetic force. A computational scheme is proposed in connection with the moving element method for global simulations in the time domain. The results are validated against test cases from the literature.

Yingjie Wang et al. [11] examine a Tuned Rail Damper to mitigate the vibrations of subway tracks. A laboratory hammer test was conducted to assess the vibration performance of a 3-interval subway track installed with dampers. Thanks to the flexural strengthening effect of the dampers, the new system has a robust ability to reduce vibrations, which can reduce the risk of clip failure in a fastening system subjected to intensive excitations by moving trains.

Ground Vibration

Lutz Auersch [12] reports the results of hammer and train excitation measurements from several locations and draw general conclusions by comparison with the results obtained by simplified methods. One-third-octave spectra show stiffness-dependent amplitudes and low- and high-frequency filtering effects due to soil layering and damping. It is concluded that the experimentally obtained attenuation exponent agrees well with the theory.

Structural Damage Identification

Alaa Diab and Tamara Nestorović [13] aim to improve the accuracy and reliability of damage detection methods that use piezoelectric sensors, which are popular due to their non-destructive and non-invasive nature, by investigating possible enhancements to a hybrid damage detection method that, in addition to the energy loss damage

index, uses Time-of-Flight criteria of acquired signals. The obtained results indicate high accuracy and reliability.

Amanda A. S. R. de Sousa et al. [14] analyze the structural integrity of a beam-like structure. The performance of six different machine learning algorithms is analyzed and discussed in terms of their ease of implementation and ability to accurately classify the dataset and indicate the beam's integrity. Excellent results are achieved by inputting a simulation-generated dataset and only slightly worse with an input dataset provided by experimental tests.

Advances in Impact Mechanics and Computational Sciences

Kasilingam Senthil and Rachit Sharma [15] investigate the impact loading behavior of concrete slabs in ABAQUS software. Five well-known damage plasticity models are tested for their accuracy and reliability for different concrete strengths and slab thicknesses by comparison with experimental results available in the literature under low-velocity impact. The obtained predictions are subjected to statistical analyzes and conclusions about adequacy are drawn.

Ankush Thakur and Kasilingam Senthil [16] carry out numerical simulations of clay and concrete brick masonry against impact loading considering varying aspect ratio and boundary conditions in ABAQUS software. Numerical results of contact force history, deformation and energy absorption were found to be in good correlation with experimental tests, namely the maximum deviation between predicted and measured peak contact force was less than 10%.

Vibration Transmission and Energy Flow Analysis of Engineering Structures and Nonlinear Systems

Chendi Zhu et al. [17] analyze the vibration energy transfer characteristics of laminated composite plates with straight or variably angled fiber paths subjected to distributed force excitation. An analytical approach, validated numerically, reveals that structural intensity streamlines can identify energy sources, energy sinks and transfer pathways, so that optimization of fiber paths could lead to the formation of low-vibration vortex-type flow.

Cui Chao et al. [18] analyze the performance of a nonlinear friction inerter vibration isolator. They concluded that the use of a nonlinear inerter can reduce power flow and vibration transmission over a wide frequency band, but the inerter's self-friction can only mitigate the vibration when the excitation amplitude is large enough to overcome the inerter's friction, proving that dry self-friction should been considered in the design of the isolator.

Modeling, Simulation and Control of the Dynamical Behavior of Aerospace Structures

Angelo Tusset et al. [19] numerically investigate how a nonlinear dynamic vibration absorber can mitigate vibration and improve passenger comfort by reducing the acceleration in the elevator cabin under excitation induced by the lateral movement representing deformations and misalignment of the guide rails. They demonstrated that a suitable configuration of such a vibration damper is necessary to ensure a better level of comfort for passengers.

Computational Efficiency in Wave Propagation and Structural Dynamics Analyses

Aram Soroushian and Peter Wriggers [20] propose a new technique for continuing time integration of nonlinear dynamic analysis when iterations fail to converge. They study how the proposed change affects the response accuracy, improves the analysis efficiency and simplicity, and what the limitations are. As an example, the New Zealand seismic code is chosen as the only seismic code with an established analytical procedure for nonlinear time history analysis.

It is sincerely hoped that readers will find in this special issue dedicated to WMVC 2022 a wide range of research topics, providing an overview of current problems in wave mechanics and vibration engineering, and thus serving as purposeful, challenging and stimulating new ideas for researchers and students interested in vibration engineering and science.

I take this opportunity to thank my colleagues, Rodrigo Gonçalves and Tiago Silva, for agreeing to join the local organizing committee. I thank the organizers of the Mini-Symposia for their contribution to the success of the conference. I would also like to thank the members of the Scientific Committee for their support.

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