Special Issue on Noise and Vibrations

Preface

Noise and vibrations, a subject of intense research in academia and industry, has a strong impact on the socio-economic world. Noise is a major form of environmental pollution that affects the lives of hundreds of millions of people, while vibration affects the safety and performance of equipment and instruments. The understanding of noise and vibration mechanisms is increasingly important for the design of modern transportation structures (road, rail and air), civil engineering infrastructure and industrial machinery. This is exacerbated by the trend to lighter, more fuel-efficient aerospace structures, which tend to be more prone to noise issues. The requirement for reduced interior and exterior noise – for both comfort and legislative reasons – drives the need for improved methods for modelling, design and control of noise.

This Special Issue of *Advances in Aircraft and Spacecraft Science* (AAS) contains selected, extended and peer-reviewed papers that were initially presented at the conference **Noise and Vibration: Emerging Methods 2018** (NOVEM 2018) in Ibiza, Spain, from May 7th to May 9th, 2018 (https://novem2018.sciencesconf.org/). The 6^{th} in the series of NOVEM conferences, NOVEM 2018 was a major gathering of researchers, from research establishments and from industry, working in the areas of noise and vibration. The emphasis of the conference series is on new and emerging methods, techniques and technologies – theoretical, numerical and experimental – in acoustics and vibration. Subject areas include structural vibration, noise and vibration control, vibro-acoustics and flow-induced noise and vibration, and give an opportunity to delegates to exchange scientific, technical and experimental ideas. It has been running since 2000. The next conference in the series, NOVEM 2021 (https://www.novem2021.ac.nz/) will be held in Auckland, New Zealand in January 2021.

The present Special Issue highlights the current state-of-the-art in aspects of this field relevant to the aims of the AAS International Journal. It contains six papers, selected from those presented at NOVEM 2018.

In the first contribution to this Special Issue, Robin *et al*. (2019) investigate exact and distorted similitudes and the related scaling laws for the analysis of both dynamic response and radiated power of rectangular plates. The response of a given panel in similitude to another is determined from a generalization of the modal approach to the analysis, allowing the use of mode shapes, natural frequencies and finally radiation functions in order to establish appropriate scaling laws. Analytical models of simply supported rectangular plates are used to produce both original and replica model responses under point mechanical excitation. Emphasis is then placed on laboratory experiments which are performed on baffled, simply supported, aluminum panels under mechanical excitation. Next Errico *et al.* (2019) propose a numerical methodology for the analysis of the flow-induced vibrations of periodic and axially-symmetric structures. The approach involves a transfer matrix to couple the translating load to the required (target) degrees of freedom. The method, through which the Green functions are calculated, is based on a wave finite element method (WFEM), reformulated for the case of axially-symmetric structures and applicable for complex and tapered shapes. Then Del Broccolo *et al*. (2019) investigate numerically the vibration filtering properties of different hybrid cellular structures possessing zero in-plane Poisson's coefficient using two different approaches: the finite element method and WFEM. The implementation of the Floquet-Bloch periodic boundary conditions through a transfer matrix method for one-dimensional vibration bandgap prediction provides a resource for the investigation of such structures, with the numerical results for frequency response and dispersion curves identical to those obtained using commercial software. The authors analyse a hybrid cellular core pattern, focusing on the investigation of the spectral bandgap characteristics that a hybrid core exhibits and its relation to that of the "parent" homogeneous cell cores. Among several configurations, Auxhex is seen to be the topology which shows the largest number of bandgaps.

In the fourth contribution to this Special Issue, Yang *et al*. (2019) give recommendations for the placement of dynamic pressure sensors for transonic wind tunnel tests. By means of several test campaigns performed on a surface aft of a ramp at transonic speeds, the authors, based on the SFP data arising from the tests, determine the best locations for streamwise sensor pairs for shocked and unshocked flows, based on minimizing the rms acceleration response of the panel. In the fifth paper, Hambric *et al*. (2019) performs numerical investigations, using hybrid RANS/LES CFD, of the wall pressures applied to a structural FE model. Then, using a transfer function time domain approach, they investigate the panel vibrations induced by wall-bounded jet flow from an upstream high aspect ratio rectangular nozzle. Correlation analysis and wavenumber-based assessments of the wall pressure loading show that strong, negative, backward-traveling components within and between shock cells are important exciters of structural vibration and should be considered for on-design operating conditions with transonic discharge flow. The negative traveling pressure waves are concentrated near the nozzle discharge and are caused by interaction between the turbulence in the shear layer and the shock cells, with forward and backward scattered waves loading the surface.

Wavenumber analysis of the wall pressure field and modal response is useful for identifying the causes of peak vibrations. The last contribution of this Special Issue, by Biedermann *et al.* (2019), provides insights into Design of Experiments applied to aeroacoustic and vibroacoustic problems, while comparing different experimental designs and approximation models. For this purpose, an experimental rig, comprising a ducted, low-pressure fan, was developed that allows both aerodynamic and aeroacoustic data to be gathered while three, independent process parameters are analysed. The experimental designs used to sample the design space are a Central Composite design and a Box-Behnken design, both used to model a response surface regression, and Latin Hypercube sampling to model an Artificial Neural network.

The guest editors hope that the present issue will be of interest to AAS readers and those working in the field of noise and vibrations. We would also like to take this opportunity to thank the NOVEM Committee for allowing to manage and coordinate the work behind this issue, the authors for their valuable works, the reviewers for their anonymous but invaluable support and the Editor-in-Chief, Professor Erasmo Carrera, for this opportunity.

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