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Section Acoustics and Vibrations



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Section Information

The “Acoustics and Vibrations” Section of *Applied Sciences* is open to receive high quality original research and review articles related to all aspects and applications of acoustic and elastic waves, as well as vibrations both in their active and passive form. This includes cases where waves are deliberately excited for monitoring purposes (such as ultrasound applied on a human patient, or structure), as well as study of seismic waves or acoustic emissions originating for example from crack propagation within a material, or acoustic conditions in a concert hall. The focus is on the development of innovative techniques and material properties or processes monitored. The innovation can be the technique itself or the material being inspected. All manuscripts submitted for publication in this section will undergo a thorough peer review process and will be published rapidly online on acceptance.

Section Editor-in-Chief

Prof. Dr. Dimitrios G. Aggelis

Subject Areas

- Acoustic and elastic waves for non-destructive evaluation and structural health monitoring
- Acoustic emission in materials and structures
- Architectural acoustics
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- Wireless monitoring and energy harvesting

Content Highlights



The Only Architectural Testimony of an 18th Century Italian Gordonia-Style Miniature Theatre: An Acoustic Survey of the Monte Castello di Vibio Theatre

Authors: Lamberto Tronchin, Ruoran Yan and Antonella Bevilacqua

Abstract: The acoustic characteristics and spatial features of the world's only surviving Italianate Gordonia-style miniature theatre, one of the smallest theatres in the world, have inspired the author to analyse the acoustic behaviour of the Monte Castello di Vibio theatre, also called "Teatro della Concordia". In this paper, the geometric and architectural features of this historical and unique performing art space were first reproduced, considering that these features are essential factors affecting acoustic characteristics. Subsequently, the acoustic measurements were taken throughout the stall and inside some selected boxes, and their main parameters were acoustically characterised according to ISO 3382-1. Lastly, the main acoustic parameters of the Monte Castello di Vibio theatre were compared to those of the 1763 theatre in Bologna, which is also a miniature theatre of similar size. The aim is to explore the main influences on the acoustic parameters of miniature theatres, and the results show that the plan layout of the theatre and interior decoration are the main factors influencing the acoustic characteristics rather than volume. Preserving the acoustic features of this unique heritage building is also seen as one of the goals of this paper.

<https://doi.org/10.3390/app13042210>



Acoustic Characterization and Quality Assessment of Cremona's Ponchielli Theater

Authors: Lamberto Tronchin, Antonella Bevilacqua and Ruoran Yan

Abstract: The Ponchielli theater of Cremona was built in 1808 after a fire destroyed the old wooden structure. The interior, the architecture and the shape of the plan layout are reminiscent of the Teatro alla Scala, Milan, a masterpiece by the architect Piermarini, albeit on a smaller scale. The four orders of balconies crowned by the top gallery are typical features of a 19th Century Italian Opera theater. Acoustic measurements have been undertaken across the stalls and in some selected boxes according to ISO 3382. The main acoustic parameters resulting from the measurements have been used for the acoustic calibration of a 3D model representing the Ponchielli theater. The calibration has been used to compare different scenarios involving the acoustic response of the main hall at 50% and 100% occupancy. The outcomes indicate that no significant change can be detected when the seats are provided with robust upholstery, which can be considered a positive result, especially for the actors who are not forced to change their effort between rehearsal and live performance...

<https://doi.org/10.3390/app13064057>



Structural Health Monitoring and Management of Cultural Heritage Structures: A State-of-the-Art Review

Authors: Michela Rossi and Dionysios Bournas

Abstract: In recent decades, the urgency to protect and upgrade cultural heritage structures (CHS) has become of primary importance due to their unique value and potential areas of impact (economic, social, cultural, and environmental). Structural health monitoring (SHM) and the management of CHS are emerging as decisive safeguard measures aimed at assessing the actual state of the conservation and integrity of the structure. Moreover, the data collected from SHM are essential to plan cost-effective and sustainable maintenance solutions, in compliance with the basic preservation principles for historic buildings, such as minimum intervention. It is evident that, compared to new buildings, the application of SHM to CHS is even more challenging because of the uniqueness of each monitored structure and the need to respect its architectural and historical value. This paper aims to present a state-of-the-art evaluation of the current traditional and innovative SHM techniques adopted for CHS and to identify future research trends. First, a general introduction regarding the use of monitoring strategies and technologies for CHS is presented. Next, various traditional SHM techniques currently used in CHS are described...

<https://doi.org/10.3390/app13116450>



Numerical Assessment of Interacting Structural Units on the Seismic Damage: A Comparative Analysis with Different Modeling Approaches

Authors: Mattia Schiavoni, Ersilia Giordano, Francesca Roscini and Francesco Clementi

Abstract: The conservation of the historical and artistic heritage is one of the main priorities of Italian and international policy. The great variety of masonry buildings that make up this heritage is characterized by different combinations of materials and construction techniques. Then, several damage scenarios could be observed as a result, requiring appropriate retrofitting interventions. A rather accurate structural behavior analysis, especially for horizontal load conditions, allows for elaborating a correct seismic assessment. Albeit there are various numerical tools available to examine them, each one's process starts by means of certain assumptions that could not be applied indiscriminately. This paper aims to compare two different types of modeling techniques to evaluate their strengths and weaknesses. To achieve this goal, an earthquake-damaged complex in Central Italy was chosen as a case study. The structure was modeled using a finite element (continuous) and a distinct element (discontinuous) method...

<https://doi.org/10.3390/app13020972>



Measurements of Room Acoustic and Thermo-Hygrometric Parameters—A Case Study

Authors: Nicola Granzotto, Ruoran Yan and Lamberto Tronchin

Abstract: Equipment, sound sources, operators, microphone placement, calculation techniques, and thermal–humidity measurement conditions all have an impact on the measurement of impulse responses when several channels are present. However, the thermal–humidity variable, which is a significant component of these factors impacting the assessment of acoustic characteristics, is commonly overlooked in research. The effects of altering temperature, relative humidity, and air velocity on acoustic parameters are investigated in this paper through experimental activities carried out in an experimental room. The patterns of fluctuation of a range of room acoustic characteristics are examined, data are acquired, and statistical analyses based on R (language and environment for statistical computing and graphics) are generated in order to ascertain the relationship between the variation of acoustic parameters and the variation of thermo-hygrometric parameters. Finally, a statistical analysis reveals relationships between thermal and hygrometric variables and interior acoustic characteristics.

<https://doi.org/10.3390/app13052905>

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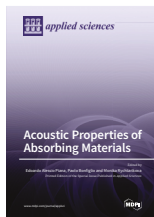
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