

Structural Modeling and Experimental-Numerical Correlation of the Dynamic Behavior of the Portuguese Guitar by Using a Structural-Fluid Coupled Model

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Abstract : The Portuguese guitar is a pear-shaped plucked chordophone particularly known for its role in Fado, the most distinctive traditional Portuguese musical style. The acknowledgment of the dynamic behavior of the Portuguese guitar, specifically of its modal and mode shape response, has been the focus of different authors. In this research, the experimental results of the dynamic behavior of the guitar, which were previously obtained, are correlated with a vibro-acoustic finite element model of the guitar. The modelling of the guitar offered several challenges which are presented in this work. The results of the correlation between experimental and numerical data are presented and indicate good correspondence for the studied mode shapes. The influence of the air inside the chamber, for the finite element analysis, is shown to be crucial to understand the low-frequency modes of the Portuguese guitar, while, for higher frequency modes, the geometry of the guitar assumes greater relevance. Comparison is made with the classical guitar, providing relevant information about the intrinsic differences between the two, such as between its tones and other acoustical properties. These results represent a sustained base for future work, which will allow the study of the influence of different location and geometry of diverse components of the Portuguese guitar, being as well an asset to the comprehension of its musical properties and qualities and may, furthermore, represent an advantage for its players and luthiers.

Keywords : dynamic behavior of guitars, instrument acoustics, modal analysis, Portuguese guitar

Conference Title : ICMASMC 2015 : International Conference on Music Acoustics, Sound and Music Computing

Conference Location : London, United Kingdom

Conference Dates : December 10-11, 2015