



Effect of bracing pattern of guitar's front plate on modal behaviour

Ewa Skrodzka (1,2), Bogumił B. J. Linde (3), Eike Rosenfeld (4) and Antoni Krupa (2)

(1) Institute of Acoustics, A. Mickiewicz University, Umultowska 85 , 61-614 Poznań , Poland

(2) Faculty of String Instruments, Harp, Guitar and Violin - Making, I.J. Paderewski Academy of Music, Św. Marcin 87, 61-808 Poznań, Poland

(3) Institute of Experimental Physics, Gdańsk University, Wita Stwosza 57, 80-952 Gdańsk, Poland

(4) Department of Engineering and Natural Science, Merseburg University of Applied Science, Geusaer Straße 88 , D - 06217 Merseburg, Germany

PACS: 43.75 Gh, 43.75 Yy

ABSTRACT

The main aim of the presented paper is to show differences between two guitars in their natural frequencies, modal damping and mode shapes, one of the instruments in armed and one in non-armed state. Both instruments were made almost identically. The only intentionally introduced difference was a in the bracing patterns of their front plates, being similar to traditional symmetric shape introduced by Antonio de Torres in one case and unsymmetric in the other one. The intention of the modification was to improve the sound of the instrument in the low-frequency range.

Two experiments were performed: (i) mechanical modal analysis (version with a fixed response point) of the front plates and (ii) optical measurements of plate velocities in those modal frequencies found in the first experiment using a scanning laser Doppler velocimeter. Both experiments were performed on instruments with and without arming, respectively. Thus the evolution of their vibrational behaviour along succeeding construction phases could be observed and-evaluated.

Our results provide a better insight into the guitar mechanics and sound radiation allowing the improvement of design and acoustic quality of the instruments.

The work was supported by the National Centre for Investigation and Development, grant N N105 058437.