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Numerical modeling of normal modes of body of a Setar

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Abstract

In this work, eigen modes and eigen frequencies of the body (sound board and sound box) of the setar, a persian stringed musical instrument, are studied. Eigen modes of the sound board and the whole body, neglecting the holes, are calculated independently and analyzed comparatively. This scheme of separate modal analyses for different parts of the Setar will lead to the understanding of their individual roles in the overall output sound. In categorizing and assessment of sound quality of musical instruments, the study of characteristics of frequency response function (ERF) is important. In case of stringed musical instruments like Setar, of the defining parameters are the first peak of FRF and its location. This first peak usually coincides with first air eigen frequency which in the present research occurs at about 377 Hz. Thus, all the other eigen modes like 588 Hz and 740 Hz, construct the rest of the FRF. Also, the effects of such as sound board thickness, wood material properties shape of sound box and other structural features of Setar on two value of eigon frequencies can assessed. Furthermore, analysis of the aero-acoustic pressure contours and the eigen modes of the Setar structure (sound board and box) and air allows the nature (air, structure or coupled air-structure) of a acoustic mode to be determined.

Keywords: Setar, Eigen frequency, Aero-acoustic, Finite element method.

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