Influence of Changing Cylinder Length on Acoustic Characteristics of Sound Field in Cylindrical Enclosure with Excited End Plate

by

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Abstract

. In order to study the coupling phenomena between the vibration of a structure and a sound field in contact with the structure, a cavity surrounded by a rigid cylinder having a thin elastic plate at both ends is adopted as an analytical model. When the dimensions of the cylindrical structure are varied, numerous parameters have to be treated as influencing factors, because their changes cause the natural frequencies of the systems to shift with respect to the above coupling phenomena. In the present investigation, changes in cylinder length, which influence the coupling between the vibrations of both end plates and the sound field inside the cavity, are studied through the characteristics of each system. In particular E_R, which is defined as the energy ratio of the sound field including all modes except a specific acoustic mode to that including all acoustic modes, estimates the degree of influence of each mode on the acoustic characteristics. As a result of this investigation, it is clarified that if the displacement of the excited plate corresponds to the sound pressure level on a lateral cross-sectional plan of the sound field in the mode, the acoustic mode in the vicinity of the excitation frequency strongly influences the acoustic characteristics and the coupling phenomena. However, if some acoustic modes, which are similar in longitudinal order, exist in the vicinity of the excitation frequency, they both cannot become an occupation mode.

Keywords: Coupled vibration, Circular end plate, Cylindrical sound field, Cylinder length, Contribution

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