9-12 AUGUST 2015
inter.noise 2015
SAN FRANCISCO, CALIFORNIA USA

Low frequency radiation modes of cylindrical shells based on system spatial decomposition

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In this paper, low frequency radiation modes of a cylindrical shell are derived based on system spatial decomposition. Radiation modes are a specific distribution of the shell normal velocity which radiate sound from the structure to the surrounding space, independently. A simply supported cylindrical shell is considered in this study. Governing vibration equations are derived based on extended Hamilton's principle and Donnel-Mushtari shell theory. Simplified Kirchhoff-Helmholtz integral is used for calculating the radiated sound pressure. It is shown that in low frequency excitation there is a big gap between the first mode radiation efficiency and those of the other radiation modes. Thus, good sound attenuation can be occurred only by controlling the first radiation mode. These modes have been derived for beams and plates in many of previous studies. However, radiation modes of cylindrical shells have not been extracted based on system spatial decomposition.

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