Waves on fluid-loaded shells and their resonance frequency spectrum - DTU Orbit (30/12/2018)

Waves on fluid-loaded shells and their resonance frequency spectrum

Technical requirements for elastic (metal) cylindrical shells include the knowledge of their natural frequency spectrum. These shells may be empty and fluid-immersed, or fluid-filled in an ambient medium of air, or doubly fluid-loaded inside and out. They may support circumferential waves, or axially propagating waves both in the shell material, and in the fluid loading. Previous results by Bao et al. (J. Acoust. Soc. Am. 105 (1999) 2704) were obtained for the circumferential-wave dispersion curves on doubly loaded aluminum shells; the present study extends this to fluid-filled shells in air. For practical applications, steel shells are most important and we have here obtained corresponding results for these. To find the natural frequencies of cylindrical shells, one may invoke the principle of phase matching where resonating standing waves are formed around the circumference, or in the axial direction if the cylindrical shell is terminated at both ends. In this way, we obtain (circumferential and axial wave) eigenfrequency spectra for water filled aluminum and steel shells, and also for brass shells (axial-wave resonances only).

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