Asymptotic Analysis of Fluid-Loaded Elastic Plates

J.Kaplunov, L. Prikazchikova, and S. Shamsi

School of Computing and Mathematics, Keele University, Keele ST5 5BG, UK

Most of the publications on the subject rely on *ad hoc* formulations using the classical 2D Kirchhoff plate equation or its engineering refinements. A few previous efforts, e.g., see [1,2], implementing an asymptotic approach for an elastic plate or shell, consider fluid loading as prescribed Neumann type boundary conditions underlying the derivation for a 'dry' plate, i.e., a plate not interacting with fluid, starting from 3D elasticity.

In this talk, we develop an asymptotic framework for a plate with specific pseudodifferential boundary conditions governing fluid loading. The adapted low-frequency scaling supports the so-called 'fluid-borne bending wave', which is not a feature of a dry structure. The peculiarities of the leading-order and several higher-order approximations are discussed, along with comparisons with previous less rigorous considerations.

1. J.D.Kaplunov, L.Yu.Kossovich, and E.V.Nolde. Dynamics of Thin Walled Elastic Bodies. Academic Press, N.Y., 1998, 226 p.
2. A.V.Belov, J.D.Kaplunov, and E.V.Nolde. A refined asymptotic model of fluid-structure interaction in scattering by elastic shells. – Flow Turb. Comb. 61 (1999), 255-267.