Radiation and scattering from finite fluid-loaded elastic plates using the Rational Function Approximation

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A new approach to fluid-structure interaction problems involving plates in acoustic media is discussed. Normally, the continuity conditions at the plate are satisfied via a boundary integral, which must be solved throughout the region of the plate. Recently, DiPerna and Feit showed that the time harmonic Green's function for an infinite fluid loaded plate can be accurately expressed using a Rational Function Approximation. In this paper we show that the RFA when applied to plates reduces the boundary integral equation to one over the perimeter of the plate surface. We consider the 2D and 3D problems of plates in an infinite baffle. It is shown that the 2D solution for a line driven plate can is semi-explicit, as it only requires satisfying the two end conditions. For the 3D problem the edge conditions reduce the problem to a one dimensional integral equation, which is solved by collocation. In general, the method permits rapid numerical solution by reducing the dimensionality of the problem by one. Applications to forced plates, acoustic scattering, and plates with other edge conditions are mentioned.