

An Approximate Method for Scattering by a Membrane Structure

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Scattering of waves by a thin structure is considered in this work. Helmholtz's equation with variable coefficient models the wave phenomena. The scatterer is assumed to have a high index of refraction while at the same time it is very small in one of the dimensions. We show that if the index scales as $O(1/h)$ where h is the thickness of the scatterer, then an approximate solution, based on perturbation analysis, can be obtained. The approximate solution consists of a leading order plus a corrector, each of which solves an integral equation in 2D for a 3D problem. We provide error analysis on the approximation. The approximate method can be viewed as an efficient computational approach since it can potentially greatly simplify scattering calculations. Numerical results provide an assessment of the accuracy of the approximate solution.