ACOUSTIC SCATTERING FROM OBSTACLES OF ARBITRARY SHAPE INCLUDING BOUNDARY SINGULARITIES

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Abstract. The current work sets forth a practical approach to numerically solve two-dimensional direct acoustic scattering problems from arbitrary shape obstacles that involve severe singularities, such as corners and cusps. First, boundary conforming coordinates are generated. This generation is performed through an elliptic grid generator algorithm, including control of the coordinate lines. The grid curves control solely depends on the initial distribution of grid points. Following the grid generation process, the BVP is formulated in terms of the new curvilinear coordinates, and a finite-difference time domain method is implemented. The presence of the boundary singularities causes instability of the numerical method. However, by appropriately controlling the distance of the grid lines in the vicinity of these singularities, stability and convergence are achieved. A semi-analytical formula for the differential scattering cross section is obtained from the discrete Fourier transform of the computed scattered pressure field. The method is successfully applied to several interesting scatterers of various shapes.

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