Implementation of a high frequency scattering by convex curvilinear polygon

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Abstract

Consider scattering of a time-harmonic acoustic incident plane wave by a sound soft convex curvilinear polygon with Lipschitz boundary. Standard boundary or finite element methods, with a piecewise polynomial approximation space, the number of degrees of freedom required to achieve a prescribed level of accuracy grows at least linearly with respect to the frequency of the incident wave. Langdon, Mokgolele and Chandler-Wilde proposed a novel Galerkin boundary element method with a hybrid approximation space, consisting of the products of plane wave basis functions with piecewise polynomials supported on several overlapping meshes, a uniform mesh on illuminated sides and graded meshes refined towards the corners of the polygon on illuminated and shadow sides. Numerical experiments suggest that the number of degrees of freedom required to achieve a prescribed level of accuracy need only grow logarithmically as the frequency of the incident wave increases. In this paper we discuss issues related to fully implementation of their numerical method.