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Acoustic scattering by fractal screens

We study time-harmonic acoustic scattering in $\mathbb{R}^n$ ($n = 2, 3$) by a fractal planar screen, assumed to be a non-empty bounded subset Γ of the hyperplane $\Gamma_\infty = \mathbb{R}^{n-1} \times \{0\}$. We consider two distinct cases: (i) Γ is a relatively open subset of Γ_∞ with fractal boundary (e.g. the interior of the Koch snowflake in the case $n = 3$); (ii) Γ is a compact fractal subset of Γ_∞ with empty interior (e.g. the Sierpinski triangle in the case $n = 3$). In both cases our numerical simulation strategy involves approximating the fractal screen Γ by a sequence of smoother "prefractal" screens, for which we compute the scattered field using boundary element methods that discretise the associated boundary integral equations. We prove sufficient conditions on the mesh sizes guaranteeing convergence to the limiting fractal solution, using the framework of Mosco convergence. We also provide numerical examples illustrating our theoretical results.