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Extended isogeometric boundary element method using the numerical steepest decent method

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Isogeometric analysis [1] (IGA) of acoustic scattering on unbounded domains has, as in many other fields, shown promising results. Methods that introduce an artificial boundary (infinite element method, PML-method, etc.) to handle the unbounded domain introduce the problem of surface-to-volume parametrization between the scatterer and the artificial boundary reducing the quality of the bridge between design and analysis provided by IGA. As the boundary element method (BEM) avoids this problem in only requiring a parameterization of the scatterer, it represent the ideal bridge between design and analysis using IGA. As for the classical boundary element method, the resulting basis functions in IGABEM is not suited for highly oscillatory problems. An attempt to solve this problem is by enriching the basis functions with oscillatory functions as in [3].

Building upon the work by Peak et al. [3] and Simpson et al. [4], we try to solve the problem of integrating highly oscillatory functions using the numerical steepest decent method [2]. We here restrict ourselves to 3D rigid scattering in homogeneous unbounded domains governed by the Helmholtz equation. The implementation is tested on the sphere problem before extending to a much more complicated submarine benchmark problem.

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