Efficient Assembly of BEM Matrices Using ACA on Distributed Systems

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Abstract

The boundary element method (BEM) reduces the considered problem to the boundary of the computational domain [3]. This makes it well suited for treatment of problems stated on unbounded domains, such as sound or electromagnetic wave scattering. However, its high computational intensity and large memory footprint requires us to use some form of a low rank approximation scheme to reduce the computational time and the size of the system matrices. In this work we present a distributed version of the adaptive cross approximation (ACA) method for BEM [1] based on the cyclic graph decomposition described in [2]. Moreover, we focus on our modification of the ACA algorithm based on geometric properties of the problem mesh, which is used to treat usually problematic zero matrix blocks and to ensure a robust assembly of the approximated matrices. We then briefly describe the Helmholtz problem and showcase weak and strong scaling of the Helmholtz BEM operators assembly using our scheme on distributed memory systems.

References

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