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Adaptive Cross Approximation.

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We discuss efficient numerical methods for multidimensional integral equations based on the Adaptive Cross Approximation method (ACA), [1]. This method was first developed for efficient numerical methods for the boundary integral formulation of various three dimensional boundary value problems for the Laplace equation, Helmholtz equation and for the system of Lamé equations, [2]. The corresponding boundary integral equations will be discretised using Galerkin method leading to a system of linear equations with a dense matrix A of some dimension N. A naive strategy for the solution of the corresponding linear systems would need at least $O(N^2)$ arithmetical operations and memory. The ACA method generates a hierarchical low-rank approximation from the matrix itself using only few approximating entries and without using any explicit a priori known degenerate kernel approximation leading to almost linear complexity. In the recent paper [3], we generalise the ACA to the three-dimensional arrays the solution of the Boltzmann equation. The efficiency and convergence properties of the numerical method (Galerkin discretisation, ACA approximation of matrices, iterative solution) will be illustrated for a number of different boundary value problems and for different surfaces as well the efficiency of the numerical solution of the Boltzmann equation.

References

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