Wavelets meet boundary integral equations

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Abstract

Solving boundary integral equations by the Galerkin scheme leads to densely populated system matrices which are often ill conditioned. Thus, the memory consumption and the computation of the solution is of at least quadratic complexity. This makes the boundary element method unattractive for the practical usage. In recent years, algorithms like the Fast Multipole Method and the Panel Clustering have been developed to reduce the complextity considerably. Another efficient method is the wavelet Galerkin scheme: one employs biorthogonal wavelet bases with vanishing moments for the discretization of the given boundary integral equation. The resulting system matrix is quasi-sparse and can be compressed without loss of accuracy such that linear over-all complexity is realized. This talk concerns with the principles as well as new developments of the wavelet Galerkin scheme for boundary integral equations, particularly assembling the compressed system matrix, preconditioning and adaptivity. Numerical experiments are presented which complement the theory. The matrix compression does not compromise the accuracy of the Galerkin scheme. However, we save a factor of storage 100–1000 and accelerate the computing time up to a factor 100.