An Adaptive Wavelet Method for the Solution of Boundary Integral Equations in Three Dimensions

In science and engineering one often comes across partial differential equations in three dimensions, some of which can be formulated as boundary integral equations on the boundary of the three-dimensional domain of interest. With this approach the dimensionality of the problem can be reduced by one dimension and the interior as well as the exterior problem can be solved. However, this advantage does not come entirely without cost, as the involved matrices are dense. By using a wavelet scheme many matrix entries become sufficiently small such that they can be neglected without compromising the convergence rate of the underlying Galerkin scheme. In this thesis we go a step further and use an adaptive wavelet approach, meaning that specific parts of the geometry will be resolved with much detail, while other parts can stay coarse. After we have introduced the necessary theoretical foundation on boundary integral equations, wavelets and adaptive wavelet schemes, we present the details on the implementation followed by several numerical results. In the final chapter of this thesis we present the concept of goal-oriented error estimation, again followed by numerical results.