Hadamard Singular Integral Equations and their Wavelet Methods

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We consider the applications of Hermite trigonometric wavelets in the natural boundary integral equations which possess the kernel with the singularities of high order (in Hadamard sense). The idea and theory of Hadamard singular integral equations is a generalization of the singular integral equation with Cauchy kernel. In this paper the Neumann type boundary value problems for the Laplacian equation, biharmonic equation, plane elasticity problems and Stokes problems in the disk are reduced into the equivalent natural boundary integral equations with the singular kernel of 2 order. Hermite wavelets are applied to discretize these natural integral boundary equations and the corresponding stiffness matrices yield very simple form. We prove that the original large linear algebraic system can be broken into smaller linear algebraic systems the coefficient matrices of which are circulant. The complexity is discussed and the error estimates are established. Finally several numerical examples are given.