Ehrich, S.; **Rathsfeld, A.**

Piecewise linear wavelet collocation, approximation of the boundary manifold, and quadrature. (English) Zbl 1002.65144

ETNA, Electron. Trans. Numer. Anal. 12, 149-192 (2001).

The authors consider boundary integral operator A of order $r = 0$ or $r = -1$ mapping $H^{r/2}$ into $H^{-r/2}$. Here an operator A takes the form $A = K$ for $r = -1$ and $A = aI + K$ for $r = 0$, where aI stands for the operator of multiplication by a function a which may be zero and the integral operator K is defined by

$$Ku(P) = \int_L f(P,Q)\frac{p(P-Q)}{|P-Q|^\alpha}u(Q)d_Q\Gamma \tag{1}$$

If $r = 0$ the integrand in (1) can be strongly singular and the integral is to be understood in the sense of a Cauchy principal value.

For the solution of the equation $Au = f$ wavelet collocation method is used. The trial space is the space of all continuous and piecewise linear functions defined over a uniform triangular grid and the collocation points are the grid points.

For the wavelet basis in the trial space the three-point hierarchical basis is chosen. The authors choose three four and six term linear combinations of Dirac delta functionals as wavelet basis in the space of test functionals. The offered algorithm requires no more than $O(N[\log N]^4)$ arithmetic operations and the error of the collocation approximation is less than $O(N^{-1}\log^2 N)$.

The paper contains a detailed bibliography on the solution of integral equations by the wavelet collocation method.

Reviewer: I.V.Boikov (Penza)

MSC:

65R20 Numerical methods for integral equations
65N38 Boundary element methods for boundary value problems involving PDEs
35J25 Boundary value problems for second-order elliptic equations
65N15 Error bounds for boundary value problems involving PDEs
65N35 Spectral, collocation and related methods for boundary value problems involving PDEs
45E10 Integral equations of the convolution type (Abel, Picard, Toeplitz and Wiener-Hopf type)
65T60 Numerical methods for wavelets

Keywords:

singular integral equations; wavelet collocation method; error bound; boundary element method

Full Text: EMIS EuDML