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Solving singular integral equations using Gaussian quadrature and overdetermined system.
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Summary: Gauss-Chebyshev quadrature and collocation at the zeros of the Chebyshev polynomial of the first kind $T_n(x)$, and second kind $U_n(x)$ leads to an overdetermined system of linear algebraic equations. The size of the coefficient matrix for the overdetermined system depends on the degrees of Chebyshev polynomials used. We show that we can get more accurate solution using $T_{3n+4}(x)$, than other $T_n(x)$.

A regularization method using a generalized singular value decomposition (GSVD) is described and compared to the Gauss-Newton method for solving the overdetermined system of equations. Computational tests show that GSVD with an appropriate choice of regularization parameter gives better solution in solving singular integral equations.

MSC:
65R20 Numerical methods for integral equations
65D32 Numerical quadrature and cubature formulas
45E05 Integral equations with kernels of Cauchy type
65F20 Numerical solutions to overdetermined systems, pseudoinverses
65F22 Ill-posedness and regularization problems in numerical linear algebra

Keywords:
Gauss-Chebyshev quadrature; overdetermined systems; generalized singular value decomposition; Tikhonov regularization; Cauchy singular integral equations; collocation

Full Text: DOI

References:

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