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Summary: A singular integral equation of the first kind is considered on the integration interval $[-1, 1]$. A solution with zero values at the endpoints of the interval is sought. The equations are discretized using Chebyshev polynomials of the second kind. The expansion coefficients of the unknown function in the Chebyshev polynomials of the second kind are obtained by solving systems of linear algebraic equations. The fact is taken into account that a unique solution of this equation vanishing at the endpoints of the integration interval exists under additional conditions on the kernels and the right-hand side. This additional condition is also discretized. The constructed computational scheme is justified by applying a function analysis method with the use of the general theory of approximate methods. The space of Hölder continuous functions with relevant norms is introduced. The differences between the norms of the singular and approximate operators are estimated. Under certain conditions, the existence and uniqueness of the solution to the approximate singular integral equation are proved, and the computational error is estimated. The order with which the remainder tends to zero is given. The proposed theory is verified using test examples, which show the efficiency of the method.

MSC:
65-XX Numerical analysis
45-XX Integral equations

Keywords:
singular integral; orthogonal polynomial; discretization of an equation; quadrature formulas; Gaussian accuracy

Full Text: DOI

References:

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