FAST SPECTRAL METHODS FOR SOLVING SINGULAR BOUNDARY INTEGRAL EQUATIONS

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We consider a singular boundary integral equation in the form $(A + B)u = f$, where A is a singular integral operator and B is a compact operator. By studying the sparse representation of operator B under the singular system of operator A, we develop a fast spectral method for solving the equation. We prove that the number of functional evaluations required to solve the equation is in order of $O(n log n)$ and the method gives an optimal order of convergence. We also prove the condition number of the coefficient matrix of the resulting discrete equation is a bounded number independent of n. Numerical examples will be presented to confirm the theoretical estimates.