

Adaptive cross approximation for ill-posed problems

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Abstract

Integral equations of the first kind with a smooth kernel and perturbed right-hand side, which represents available contaminated data, arise in many applications. Discretization gives rise to linear systems of equations with a matrix whose singular values cluster at the origin. The solution of these systems of equations requires regularization, which has the effect that components in the computed solution connected to singular vectors associated with small singular values are damped or ignored. In order to compute a useful approximate solution typically approximations of only a fairly small number of the largest singular values and associated singular vectors of the matrix are required. The present paper explores the possibility of determining these approximate singular values and vectors by adaptive cross approximation. This approach is particularly useful when a fine discretization of the integral equation is required and the resulting linear system of equations is of large dimensions, because adaptive cross approximation makes it possible to compute only fairly few of the matrix entries.

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