RECOMPRESSION TECHNIQUES
FOR ADAPTIVE CROSS APPROXIMATION

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ABSTRACT. The adaptive cross approximation method (ACA) generates low-rank approximations to suitable $m \times n$ sub-blocks of discrete integral formulations of elliptic boundary value problems. A characteristic property is that the approximation, which requires $k(m + n)$, $k \sim |\log \varepsilon|^*$, units of storage, is generated in an adaptive and purely algebraic manner using only few of the matrix entries. In this article we present further recompression techniques which are based on ACA and bring the required amount of storage down to sublinear order kk', where k' depends logarithmically on the accuracy of the approximation but is independent of the matrix size. The additional compression is due to a certain smoothness of the vectors generated by ACA.

1. Introduction. The finite element discretization of integral formulations of elliptic boundary value problems leads to fully populated matrices $K \in \mathbb{R}^{N \times N}$ of large dimension N. By the introduction of the fast multipole method [15], the panel clustering method [21], the wavelet Galerkin method [1], and hierarchical ($\mathcal{H}$-) matrices [17, 19] it has become possible to treat such matrices with almost linear complexity. While most of these methods can be used only to store and to multiply approximations by a vector, $\mathcal{H}$-matrices provide efficient approximations to the matrix entries. The latter property is useful because preconditioners can be constructed from the matrix approximant in a purely algebraic way; see [4].