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Novel preconditioning techniques in matrix computations

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As a complement to popular multiplicative preconditioners, we introduce and analyze additive preconditioners for matrix computations. We define structured pseudo random additive preconditioners, which are almost as effective as the SVD-based multiplicative preconditioners but are more robust and more readily available. By using appropriate aggregation processes, we transform these preconditioners into effective multiplicative preconditioners, which preserve the structure of an input matrix. We apply our techniques to compute the solution of a linear system of equations, the determinant, the rank and null vectors of a matrix, a tail of its SVD, and its eigenvectors. Our analysis and extensive experiments show the efficiency of our approach.