

Combining Schur interpolation and Schur elimination to produce new types of matrix conditioners

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Matrix conditioners are approximations to the inverse of a matrix. They are instrumental in solvers for large systems of linear equations in which the original matrix is either very sparse or can be represented with a limited amount of data so that the product of the matrix with a vector is of low computational complexity. To exploit this low complexity for solving the system with an iterative algorithm, one needs in addition an approximation of the inverse with the same property of low complexity matrix-vector products. I consider the case of (large) positive definite matrices and the use of both Schur type interpolation as well as Schur type elimination to produce new conditioners (the computation of the conditioner itself must also be of low computational complexity, of course.) Classically, a Schur matrix interpolation can only be used on data that forms a band around the main diagonal. We show how the combination of the two Schur methods succeeds in producing conditioners for multi band and hierarchically multi band matrices - a goal that has proven elusive so far. I shall also discuss applications and extensions briefly.