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COMPUTATIONALLY ENHANCED PROJECTION METHODS FOR SYMMETRIC LYAPUNOV MATRIX EQUATIONS

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In the numerical treatment of large-scale Lyapunov equations, projection methods require solving a reduced Lyapunov problem to check convergence. As the approximation space expands, this solution takes an increasing portion of the overall computational effort. When data are symmetric, we show that the Frobenius norm of the residual matrix can be computed at significantly lower cost than with available methods, without explicitly solving the reduced problem. For certain classes of problems, the new residual norm expression combined with a memory-reducing device make classical Krylov strategies competitive with respect to more recent projection methods. In this talk, we present several numerical experiments that illustrate the effectiveness of the new implementation for standard and extended Krylov subspace methods.