The solution of parametrized algebraic linear systems: theory and applications

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Linear systems with parameters arise in many applications. For example, the computation of the frequency response function (FRF) of vibrating systems leads to large linear systems with the frequency as parameter. The computational cost of FRF's is high. A typical linear system takes the form

$$(K - \omega^2 M)x = f$$

where K is the stiffness matrix and M the mass matrix. The parameter ω is the frequency or wave number

In this talk, we review techniques based on Krylov subspaces, such as the Padé-via-Lanczos method (PVL) and the Arnoldi method. This class of methods have connections between Padé approximations, eigenvalue computations and iterative Krylov methods.

Special structure in the matrices may improve the computational speed. We discuss the efficient solution of systems with Rayleigh damping.

We also present recent results on the solution of linear systems with multiple right-hand sides.

Keywords: Numerical linear algebra.