Inexact Krylov methods for linear systems, matrix and tensor equations

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Abstract

It is well-known that Krylov methods are able to efficiently solve very large and sparse linear systems of the form $Ax = b$. One of the core operations within such methods is the matrix-vector product Av. In the early 2000s, many authors were interested in studying how to maintain the well-established convergence properties of Krylov methods also in case of inexact matrix-vector products. Simoncini, Szyld, van den Eshof, Sleijpen, and other researchers showed that the convergence is preserved if the allowed "inexactness" fulfills certain conditions. In this talk we review the rich, fascinating convergence theory behind inexact Krylov methods for linear systems and we illustrate how this framework can be exploited also to show the convergence of another timely family of Krylov methods, the so-called low-rank Krylov methods. The latter algorithms are one of the few options available in the literature to solve large-scale, multi-term linear matrix equations. We briefly discuss the extension of the proposed results to the solution of tensor equations as well.