# Inexact Krylov Subspace Methods for PDEs and Control Problems

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## Abstract

In many circumstances, a known good preconditioner is not easily computable. Instead, an approximation to it is available. This is the case, for example, when the preconditioner has an inverse associated with it, such as in Schur complements (e.g., in saddle point problems), or in the reduced Hessian in some control problems. The application of the preconditioner implies then an iterative solution of a linear system. In these cases, the question is: how accurately to solve the (inner) iteration? In our work on Inexact Krylov methods, we have shown that the inner iterations can be solved progressively less accurately, as the underlying Krylov method (e.g., GMRES) converges to the overall solution. Computable inner stopping criteria were developed to guarantee convergence of the overall method. We will discuss these criteria, and illustrate its application to several problems. Currently, we are applying these ideas to parabolic control problems, where the reduced Hessian has two different inverses; and thus two inner iteration criteria