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Augmentation-Based Block Preconditioners for Solving Saddle Point Linear Systems

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Macdonald-Harrington Building, Room G1

Abstract

Saddle point linear systems arise in many applications. The matrices associated with such systems are typically symmetric and indefinite, and have a 2x2 block structure with a zero block.

In this talk we discuss solution techniques, and focus on iterative methods. In particular, we address the question which preconditioners should be used. We introduce an augmentation preconditioning technique whereby the preconditioners are block diagonal with symmetric positive definite blocks and are based on augmented Lagrangian techniques. Interestingly, it is possible to show analytically that the more rank-deficient the (1,1) block of the original matrix is, the faster a preconditioned iterative scheme converges. Saddle point systems that arise in the time-harmonic Maxwell equations and interior-point methods in optimization are just two examples for situations where this feature of the preconditioner may be useful, and we illustrate our findings by a few numerical examples.