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Inexact Newton Methods for Nonlinear Programming

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The need for solving very large optimization problems arises in many important applications. A prominent example is the class of nonlinear programs whose constraints are defined by a discretized system of partial differential equations. Two significant computational challenges that arise in the solution of problems of this type are that the variables can number in the millions and the crucial iteration matrices found in contemporary algorithms cannot be explicitly formed or factored.

In this talk, we develop a globally convergent algorithm for solving equality constrained problems of this type. The algorithm is matrix-free in that only mechanisms for calculating products of vectors with Hessian and Jacobian matrices are required. The step computations can also be performed inexactly, allowing further economy of computation. A description of the algorithm, notes on its global convergence properties, and numerical results will be presented.