A first-order optimization method with simultaneous adaptive pde constraint solver

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Abstract

We consider a pde-constrained optimization problem and based on the nonlinear primal dual proximal splitting method, a nonconvex generalization of the well-known Chambolle-Pock algorithm, we develop a new iterative algorithmic approach to the problem by splitting the inner problem of solving the pde in each step over the outer iterations. In our work we split our pde-problem in a fashion similar to the classical Gauss-Seidel and Jacobi methods, though other iterative schemes may be fruitful too. We show through numerical experiments that significant speed ups can be attained compared to a naïve full pde-solve in each step, and we prove convergence under sufficients second-order growth conditions.