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A block diagonal preconditioner for PDE constrained optimization

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Optimization problems where the constraint is a partial differential equation are important in many areas of the sciences and engineering. One such formulation is the Dirichlet distributed control problem, which can be written as a saddle point system. Here we present an all-at-once method based on preconditioned MINRES, together with an efficient, optimal preconditioner which uses multigrid methods, to solve such problems.