

# Preconditioners for the Reduced Space Hessian in Hyperbolic Optimal Control Problems

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We will discuss the parallel implementation of a simplified 2-level multigrid preconditioner for linear systems that arise in the application of Gauss–Newton–Krylov schemes to hyperbolic PDE-constrained optimization problems. We will see that the considered problem is ill-posed in nature, non-linear, and non-convex, and has an infinite number of unknowns, which—upon discretization—leads to ill-conditioned, high-dimensional systems that pose significant numerical challenges. The inversion of the Hessian operator represents the bottleneck of our solver. The size and construction costs make a factorization impossible. We iteratively invert this operator using a Krylov subspace method; we only need an expression for the Hessian matvec. Each matvec requires the solution of two transport equations—the main computational costs of our solver. We will discuss properties of the preconditioned Hessian system and showcase numerical results to demonstrate the performance of our scheme.

This is joint work with George Biros.

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