NUMERICAL METHOD FOR OPTIMAL CONTROL PROBLEMS GOVERNED BY NONLINEAR HYPERBOLIC SYSTEMS OF PDES

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We present two numerical methods for solving tracking-type optimal control problems subject to hyperbolic conservation and balance laws in one and two space dimensions. Our approach is based on the formal optimality system and requires numerical solutions of the hyperbolic system of conservation or balance laws forward in time and a corresponding nonconservative linear adjoint system backward in time.

We use a second-order shock-capturing finite volume method for the forward problem, our particular choice is the Godunov-type central-upwind scheme originally developed for general multidimensional hyperbolic systems of conservation laws. For the backward problem we explore two different strategies. In the scalar case, we use a highly accurate Lagrangian discrete characteristics method. In the system case, we develop a second-order Roe-type upwind finite volume scheme.

We illustrate the performance of the proposed numerical methods on a number of optimization problems constrained by both linear and nonlinear scalar conservation laws and a duct design problem as well as the Euler equations of gas dynamics or isothermal gas dynamics equations. Both smooth and discontinuous prescribed terminal states are considered.

REFERENCES

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