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Discontinuous Galerkin method for predicting heat transfer in hypersonic environments[1] ERIC CHING, YU LV, MATTHIAS IHME, Department of Mechanical Engineering, Stanford University — This study is concerned with predicting surface heat transfer in hypersonic flows using high-order discontinuous Galerkin methods. A robust and accurate shock capturing method designed for steady calculations that uses smooth artificial viscosity for shock stabilization is developed. To eliminate parametric dependence, an optimization method is formulated that results in the least amount of artificial viscosity necessary to sufficiently suppress nonlinear instabilities and achieve steady-state convergence. Performance is evaluated in two canonical hypersonic tests, namely a flow over a circular half-cylinder and flow over a double cone. Results show this methodology to be significantly less sensitive than conventional finite-volume techniques to mesh topology and inviscid flux function. The method is benchmarked against state-of-the-art finite-volume solvers to quantify computational cost and accuracy.

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