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A New Discontinuous Galerkin Method for Convection-Diffusion Problems: The Gradient-Recovery DG Method PHILIP JOHNSON, ERIC JOHNSEN, University of Michigan, Ann Arbor — The Discontinuous Galerkin (DG) numerical method, while well-suited for hyperbolic PDE systems such as the Euler equations, is not naturally competitive for convection-diffusion systems, such as the Navier-Stokes equations. Where the DG weak form of the Euler equations depends only on the field variables for calculation of numerical fluxes, the traditional form of the Navier-Stokes equations requires calculation of the gradients of field variables for flux calculations. It is this latter task for which the standard DG discretization is ill-suited, and several approaches have been proposed to treat the issue. The most popular strategy for handling diffusion is the "mixed" approach, where the solution gradient is constructed from the primal as an auxiliary. We designed a new mixed approach, called Gradient-Recovery DG; it uses the Recovery concept of Van Leer & Nomura with the mixed approach to produce a scheme with excellent stability, high accuracy, and unambiguous implementation when compared to typical mixed approach concepts. In addition to describing the scheme, we will perform analysis with comparison to other DG approaches for diffusion. Gas dynamics examples will be presented to demonstrate the scheme's capabilities.

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