Abstract Submitted
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Fully-Implicit Reconstructed Discontinuous Galerkin Method for Stiff Multiphysics Problems[1] ROBERT NOURGALIEV, Lawrence Livermore National Laboratory — A new reconstructed Discontinuous Galerkin (rDG) method, based on orthogonal basis/test functions, is developed for fluid flows on unstructured meshes. Orthogonality of basis functions is essential for enabling robust and efficient fully-implicit Newton-Krylov based time integration. The method is designed for generic partial differential equations, including transient, hyperbolic, parabolic or elliptic operators, which are attributed to many multiphysics problems. We demonstrate the method's capabilities for solving compressible fluid-solid systems (in the low Mach number limit), with phase change (melting/solidification), as motivated by applications in Additive Manufacturing. We focus on the method's accuracy (in both space and time), as well as robustness and solvability of the system of linear equations involved in the linearization steps of Newton-based methods. The performance of the developed method is investigated for highly-stiff problems with melting/solidification, emphasizing the advantages from tight coupling of mass, momentum and energy conservation equations, as well as orthogonality of basis functions, which leads to better conditioning of the underlying (approximate) Jacobian matrices, and rapid convergence of the Krylov-based linear solver.

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