UNIVERSITY of HOUSTON

Department of Mathematics

Scientific Computing Seminar

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Convergence of a pressure-robust space-time hybridized discontinuous Galerkin method for incompressible flows

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1 PM- 2 PM
Room 646 PGH

Abstract: Much recent interest in the numerical solution of incompressible flow problems has concentrated on pressure-robust finite element methods, a class of mixed methods that preserve a fundamental invariance property of the incompressible Navier-Stokes equations. The violation of this invariance property at the discrete level manifests in a pressure-dependent consistency error that can pollute the velocity error. Two key ingredients are required for pressure-robustness: exact enforcement of the incompressibility constraint, and H(div)-conformity of the finite element solution. This talk will discuss a space-time hybridized discontinuous Galerkin finite element method for the evolutionary incompressible Navier-Stokes equations. The numerical scheme has several desirable properties, including pointwise mass conservation, energy stability, and high-order accuracy in both space and time. Through the introduction of a pressure facet variable, H(div)-conformity of the discrete velocity solution is enforced, ensuring the numerical scheme is pressure-robust. A priori error estimates for smooth solutions will be presented, as well as convergence to weak solutions in the sense of Leray and Hopf using compactness results for broken polynomial spaces.