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A DISCONTINUOUS PETROV-GALERKIN METHODOLOGY FOR INCOMPRESSIBLE FLOW: NAVIER-STOKES

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The discontinuous Petrov-Galerkin methodology with optimal test functions (DPG) proposed by L. Demkowicz and J. Gopalakrishnan guarantees the optimality of the solution in an energy norm, and provides several features facilitating adaptive schemes. Whereas Bubnov-Galerkin methods use identical trial and test spaces, Petrov-Galerkin methods allow these function spaces to differ. In DPG, test functions are computed on the fly and are chosen to minimize the residual. For well-posed problems with sufficiently regular solutions, DPG can be shown to converge at optimal rates—the inf-sup constants governing the convergence are mesh-independent, and of the same order as those governing the continuous problem [1]. DPG also provides an accurate mechanism for measuring the error, and this can be used to drive adaptive mesh refinements.

In this presentation, we employ DPG for the incompressible Navier-Stokes equations for adaptive solution of classical model problems. Numerical experiments are performed using Camellia [2], a robust, flexible software framework for DPG research and experimentation, built atop Trilinos.

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