A Parallel PSPG Finite Element Method for Direct Simulation of Incompressible Flow

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Abstract. We describe a consistent splitting approach to the pressure stabilized Petrov-Galerkin finite element method for incompressible flow. The splitting leads to (almost) explicit predictor and corrector steps linked by an implicit pressure equation which can be solved very efficiently. The overall second-order convergence is proved in numerical experiments. Furthermore, the parallel implementation of the method is discussed and its scalability for up to 120 processors of a SGI Origin 3800 system is demonstrated. A significant superlinear speedup is observed and can be attributed to cache effects. First applications to large-scale fluid dynamic problems are reported.