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Block Preconditioning the Incompressible Navier-Stokes Equations

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We consider parallel, scalable software packages for solving the incompressible Navier-Stokes equations. More specifically, we focus on developing software for block preconditioning using methods dervied from the pressure projection and Kay, Loghin, Silvester, Elman, and Wathen (KLESW) preconditioner families. Meros, a suite of N-S specific block preconditioners,is developed using TSF, a high-level block matrix manipulation language. After presenting the design rationale, some preliminary results using meros on problems from a realistic fluid flow code (MPSalsa) are presented. Comparisons between preconditioning strategies from the pressure projection (Simple) and KLESW families will be shown.