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A Quadrilateral Spectral Multidomain Penalty Method Model For High Reynolds Number Incompressible Stratified Flows JORGE ESCOBAR-VARGAS, PETER DIAMESSIS, Cornell University — We present a spectral multidomain penalty method-based incompressible Navier Stokes solver for high Reynolds number stratified turbulent flows in doubly non-periodic domains. Within the solver, time is discretized with a fractional-step method, and, in space, a Gauss-Lobatto-Legendre collocation approach is used in discontinuous quadrilateral subdomains. Stability of the numerical scheme is guaranteed through a penalty scheme and spectral filtering, further buttressed by a overintegration-based dealiasing technique. The efficient iterative solution of the associated discrete pressure Poisson equation is ensured through a Kronecker product based computation of the null vector associated with the global matrix, plus a two-level preconditioner within a GMRES solver. Efficiency and accuracy of the Navier Stokes solver are assessed through the solution of the lid-driven cavity flow, Taylor vortex and double shear layer. The canonical lock exchange problem is also presented to assess the potential of the solver for the study of environmental stratified flows.

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