Abstract Submitted
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A local grid refinement curvilinear immersed boundary method for multi-resolution simulations of complex turbulent flows[1] DIONYSIOS ANGELIDIS, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, Department of Civil Engineering, 2 Third Avenue SE, Minneapolis, MN 55414, USA — A novel numerical method for multi-resolution real life simulations is developed, solving the Navier-Stokes equations on curvilinear locally refined grids in conjunction with the Curvilinear Immersed Boundary Method (CURVIB) (Ge and Sotiropoulos, J. Comp. Phys. 2007). The governing equations are discretised on 3D unstructured grids using a hybrid staggered/non-staggered approach and employing the fractional step method; thus discretising the momentum equations fully implicitly using second-order scheme in time. The momentum equations are solved with the matrix free Newton-Krylov method, while the Poisson equation is solved by implementing the algebraic multigrid method (AMR). By using the unstructured approach, the memory requirements are minimized since all the data are stored in one dimensional arrays. Thus, adaptive cells' splitting and merging is related with memory allocation and deallocation respectively. Partitioning of the unstructured grid and parallel computing enhance the solver's performance, making the code a powerful tool capable for multi-resolution calculations of complex turbulent flows involving a large disparity of spatial scales, such as flows past wind turbine arrays. The flow solver is developed to enable large-eddy simulations, with low computational cost.

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