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Toward Simulating Turbulent Wall-Bounded Flows at High Reynolds Numbers on Exascale Platforms[1] RAMESH BALAKRISHNAN, Argonne National Laboratory, PAUL FISCHER, University of Illinois at Urbana-Champaign — Given that wall resolved LES (WRLES) of high Reynolds number flows will continue to be intractable on even exascale computing platforms, there is considerable effort to make hybrid RANS/LES (HRLES) methods the tool of choice for predictive simulations of high-Re separated flows. The fidelity of HRLES depends on the ability of the subgrid model to account for the effects of the filtered scales on the resolved scales, and on the numerical schemes that are used to evolve the Navier-Stokes equations. While higher-order numerical schemes, with low dissipation/dispersion errors (and higher arithmetic intensity), are commonly used for canonical flow simulations (on simpler geometries), the bulk of the high-Re flow simulations on complex geometry still employ nominally second-order accurate schemes in structured/unstructured flow solvers. Hence, there is a need for better sub-grid models that can improve the predictive capability of both the higher-order flow solvers and existing second-order accurate flow solvers, for simulating turbulent separated flows. This talk is about ongoing efforts to develop HRLES subgrid models from DNS/WRLES simulations of canonical flows over curved and sharply discontinuous surfaces and their ability to predict high-Re flows on current petascale platforms.

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