Abstract Submitted
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Numerical Investigations of the Leray-α Turbulence Model for Large Eddy Simulations[1] S. FRANKEL, Y. KWAN, A. CHANDY, Purdue University, S. VARGHESE, J. SHEN, Purdue University, P. FISCHER, Argonne National Laboratory — Large eddy simulations (LES) of transition to turbulence for steady flow through a model eccentric stenotic blood vessel are reported featuring the use of the Leray-α model. The Leray-α model uses a filtered velocity field for fluid advection, modifying the nonlinear vortex stretching dynamics effectively suppressing scales smaller than α, and reducing resolution requirements, in contrast to more traditional LES models which filter the entire velocity field and enhance viscous dissipation through a computed eddy viscosity. A Helmholtz differential filter, both with and without projection of the filtered field onto a divergence free space, is used to investigate the issue of incompressibility of the filtered field. The effect of filter size is also studied. The incompressible Navier-Stokes and differential filter equations are numerically integrated using an h/pspectral-element method on a grid with 2448 hexahedral cells on up to 1024 processors on the IBM Blue Gene/L at Argonne National Laboratory. Differences between instantaneous and statistical LES results (with polynomial order 7) and recent published direct numerical simulation (DNS) results (with polynomial order 13) are discussed. Additional results from Fourier pseudospectral homogeneous isotropic turbulence simulations may be employed to shed further light on the LES results.

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