عنوان مقاله:

An OpenFOAM-Based Evaluation of PANS Methodology in Conjunction with Non-Linear Eddy Viscosity: Flow Past a Heated Cylinder

محل انتشار:

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خلاصه مقاله:

We evaluate the partially-averaged Navier-Stokes (PANS) methodology of turbulence computations by including non-linear eddy viscosity based closures for both turbulent stresses and thermal flux. We extract the filtered PANS version of the Shih's quadratic model (originally proposed for the Reynolds averaged Navier-Stokes (RANS) paradigm) for arriving at a PANS closure model for the turbulent stress tensor. The unclosed thermal flux process is modeled using the gradient diffusion hypothesis, wherein we sensitize the coefficient of diffusion to the presence of non-linear stresses in the formulation. The resulting methodology is evaluated by simulating flow past a heated square cylinder. Evaluations are performed in terms of both hydrodynamic variables and heat transfer characteristics. We find that the non-linear PANS methodology shows improved results in terms of hydrodynamic quantities (coefficient of drag, pressure, velocity profiles, and high-order statistics). While the predictions of the heat transfer rate on the front face of the cylinder are similar in the linear and the non-linear PANS methodologies, in the wake region and parts of the lateral wall where shear layer detachment takes place, the non-linear PANS methodology shows improved results.

کلمات کلیدی:

linear eddy viscosity closure, Non, Scale resolving simulations, Turbulent heat transfer, PANS, Separated flows