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Enhancement of PANS with Non-Linear Eddy Viscosity Closure SAGAR SAROHA, KRISHNENDU CHAKRABORTY, SAWAN SUMAN SINHA, IIT Delhi, SUNIL LAKSHMIPATHY, Gexcon AS, Norway — In recent years partially-averaged Navier-Stokes (PANS) method has emerged as a promising bridging method for simulating turbulent flows. However, most PANS simulations reported in the literature have been performed employing linear constitutive equation for unclosed stresses. While PANS inherently addresses the limitations of Reynolds-averaged Navier-Stokes (RANS) by reducing the overly diffusive effects by choosing appropriate sub-unity values of its filter parameters, the limitations of a linear eddy viscosity model inherited from a parent RANS model still bottlenecks its performance. Indeed experimental evidence suggest that in flow past bluff bodies, there are regions where the Reynolds stress tensor is substantially misaligned with the local resolved strain rate, and a simple linear eddy viscosity assumption is not realistic. We present an enhanced version of the PANS methodology which employs a non-linear eddy viscosity model. We show that this enhancement substantially improves the prediction of various hydrodynamic as well as heat transfer statistics in flows past two representative bluff bodies: a square cylinder and a sphere. This enhanced nonlinear PANS methodology is presented as a more potent bridging method than its linear counterpart.

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