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Partially-Averaged Navier-Stokes Modeling of Turbulent Swirling Flow[1] HOSEIN FOROUTAN, SAVAS YAVUZKURT, The Pennsylvania State University — A Partially-Averaged Navier-Stokes (PANS) model is developed in this study and tested for the simulation of turbulent swirling flow. In the PANS approach, the extent of partial averaging is controlled by the unresolved-to-total ratios of turbulent kinetic energy, k, and turbulent dissipation rate, ε, which depend upon the computational grid spacing. Therefore, PANS closure model can be used at any grid resolution ranging from Reynolds-Averaged Navier-Stokes (RANS) to Direct Numerical Simulation (DNS). The present PANS model is derived from the extended $k-\varepsilon$ turbulence model of Chen and Kim (1987), where an extra time scale of the production is included in the turbulent dissipation rate transport equation. The new model is applied to the simulation of turbulent confined swirling flow through an abrupt expansion with Re=30,000 and swirl number of 0.6. The results are compared to the available experimental data, as well as those obtained using RANS and Detached Eddy Simulation (DES) on the same grid resolution.

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