A Comparison of RANS-Based Turbulence Modeling for Flow over a Wall-Mounted Square Cylinder

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Abstract:

Using experimental data from a study of flow over a wall-mounted square cylinder (h=4d) as a baseline, three Reynolds-Averaged Navier-Stokes turbulence models are used in a commercial CFD code Star-CCM+ to compare the relative accuracy of the tested models. In virtually every standard of comparison applied in this study, the Realizable ??? with a two-layer treatment proved to be far superior to both the ??? V2F (All y+ hybrid wall treatment) and the ??? models.
To observe mesh dependence for each of the models, all three were run on three different polyhedral mesh cases. Resulting first prism-layer heights of y+?12, y+?5, and y+?1 allowed comparison of results with the mesh resolved to the buffer layer, the buffer layer/viscous sublayer transformation, and into the viscous sublayer, respectively. In all cases, the Realizable ??? proved superior.
The mesh study also suggests that applying the two-layer treatment to Realizable ??? allows it to operate well into the viscous sublayer, an area in which ??? models are traditionally expected to suffer degradation in accuracy. The ??? scheme, however, does not show improvements with increased mesh quality. In contradiction to the expected results, mesh independence is reached by y+?5 for ??? in this study.

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