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Wall-resolved large-eddy simulation of flow past a circular cylinder[1] W. CHENG, King Abdullah University of Science and Technology, D.I. PULLIN, California Institute of Technology, R. SAMTANEY, King Abdullah University of Science and Technology — Wall-resolved large-eddy simulations (LES) about a smooth-walled circular cylinder are described over a range of Reynolds number from $Re_D = 3.9 \times 10^3$ (subcritical) to above the drag crisis, $Re_D = 8.5 \times 10^5$ (supercritical), where D is the cylinder diameter. The span-wise domain is $3\,D$ for $Re_D \leq 10^5$ and D otherwise. The numerical method is a fourth-order finite-difference discretization on a standard curvilinear O-grid. The stretched-vortex sub-grid scale model is used in the whole domain, including regions of large-scale separated flow. For $Re_D \leq 10^5$, calculations of the skin-friction coefficient versus polar angle θ along the cylinder surface and its dependence on Re_D are well captured in comparison with experimental data. Proper separation behavior is observed. For high Re_D, a fine mesh $8192 \times 1024 \times 256$ is used. It is found that a blowing/suction-type perturbation of the wall-normal velocity along a span-wise strip, with angular position at $\theta = 50 - 60^o$, is then required in order to produce flow separation in accordance with experiment at Reynolds numbers in the drag-crisis regime. Results presented will focus on the skin-friction behavior and details of flow separation.

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