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Characteristics of flows over a circular cylinder at critical and super-critical Reynolds numbers[1] DOHYUN JIN, HYUNSIK KIM, HAECHEON CHOI, Seoul National University — We conduct large eddy simulation of flow over a circular cylinder from the critical to super-critical Reynolds numbers (Re = 250,000, 380,000 and 850,000, respectively) with a dynamic global subgrid-scale model (Lee et al., 2010) and an immersed boundary method (Kim et al., 2001). The drag coefficients and Strouhal numbers agree well with those of previous studies. As the Reynolds number increases, fluctuations of laminar separation and stagnation positions decrease, and the non-dimensional pressure at the Karman vortex core increases. At a critical Reynolds number, asymmetric mean pressure distribution on the cylinder surface is observed. At the super-critical Reynolds number, the separated shear layer vortices breakdown into three-dimensional turbulent structures near the mean reattachment line at both sides of the cylinder. Although the turbulent reattachment is not observed at the critical Reynolds numbers, the shear layer vortex frequencies normalized with the external azimuthal velocity and momentum thickness at the separation point are almost identical to that at the super-critical Reynolds number.

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