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Characteristics of the flow over a sphere at subcritical Reynolds numbers[1] JUNGIL LEE, KWANGMIN SON, HAECHEON CHOI, Seoul National University — The characteristics of turbulent flow over a sphere at subcritical Reynolds numbers is investigated using the mode analysis. The Reynolds numbers considered are $Re = 3700$, 10^4 and 10^5. The flow fields are generated from large eddy simulation with a dynamic global subgrid-scale model based on the Germano identity [Park et al., Phys. Fluids (2006); Lee et al., Phys. Fluids (2010)]. The flow statistics are in excellent agreement with previous experimental and numerical ones. The mode analysis is conducted on the axial velocity fluctuations integrated over the radial direction at each streamwise location. The axisymmetric mode (mode 0) represents cylindrical vortex rings or sheet that envelop(s) the recirculation region, and the helical mode (mode 1) is related to hairpin vortex or wavy vortical structure in the wake. The energy at each mode is maximum near the end of the recirculation region and decreases downstream. At $Re = 3700$, mode 0 is dominant within the recirculation region but mode 1 becomes dominant in downstream locations. On the other hand, at $Re = 10^4$ and 10^5, mode 1 is most dominant throughout the flow field. These features are also manifest from instantaneous vortical structures.

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