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Numerical study on the aerodynamics of a golf ball and its comparison with a smooth sphere JING LI, MAKOTO TSUBOKURA, Faculty of Engineering, Hokkaido University, MASAYA TSUNODA, Sumitomo Rubber Industries Ltd. — The present study has numerically investigated the flow over a golf ball and a smooth sphere by conducting large-eddy simulation (LES) using hundreds of millions of unstructured elements. Simulations were conducted at various Reynolds numbers ranging from the subcritical to the supercritical regimes. Special attention was paid to the phenomenon of drag crisis as well as the effect of surface roughness on the drag crisis. The simulation result shows that the surface roughness introduced by the dimples of the golf ball causes a local instability of the flow around the ball and subsequently leads to a momentum transfer in the near-wall region inside the dimples. The flow with high momentum in the near-wall region travels further downstream, which consequently results in the drag crisis occurring at a relatively lower Reynolds number compared with that of the smooth sphere. Moreover, the Magnus effect resulting from the rotating motion of a sphere was also one of the main concerns in this study. The simulation result shows that lift forces are imposed on both the rotating smooth sphere and rotating golf ball. For most cases the lift force points to the positive direction, however, the negative lift force appears also under certain conditions.

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