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Numerical investigation of the effect of sphere dimples on the drag crisis and the Magnus effect JING LI, Laboratory of Computational Fluid Mechanics, Division of Mechanical and Space Engineering, Graduate School of Engineering, Hokkaido University, MAKOTO TSUBOKURA, Computational Fluid Dynamics Laboratory, Department of Computational Science, Graduate School of System Informatics, Kobe University, MASAYA TSUNODA, Research & Development HQ, Research Dept. 1, Sumitomo Rubber Industries, Ltd. — The present study investigates the flow over a golf ball and a smooth sphere around the critical Reynolds numbers under both stationary and self-spinning conditions by conducting Large-eddy simulations (LES) based on high resolution unstructured grids. For the stationary cases, the present calculation results validate the promotion of the drag crisis at a relatively lower Reynolds number due to the golf ball dimples. It also shows that the golf ball dimples have a limited effect on the time-dependent lateral force development in the subcritical regime, whereas the dimples are beneficial in suppressing the lateral force oscillations in the supercritical regimes. With spin parameter Γ =0.1, the drag coefficients for the spinning smooth sphere increase slightly in all Reynolds number regimes when compared to the stationary cases, whereas for the spinning golf ball, the drag force decreases in the critical regime and increases in the supercritical regime. For both spinning models, the inverse Magnus effect was reproduced in the critical regime, whereas in the supercritical regime the ordinary Magnus force was generated. Relatively weaker lift forces were also observed in the cases of the spinning golf balls when compared to the spinning smooth spheres.

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