Abstract Submitted
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Near-wake characteristics of a rotating dimpled sphere[1] JOOHA KIM, HAECHEON CHOI, Seoul National University — In this study, we investigate the characteristics of flow around a rotating dimpled sphere in the subcritical, critical and supercritical Reynolds number (Re) regimes. The experiment is performed in a wind tunnel at $Re = 0.3 \times 10^5$ – 2.4×10^5 and the spin ratio (α; ratio of surface velocity to the free-stream velocity) of 0 (no spin) – 2.6. We directly measure the drag and lift forces and the velocity field in the near wake using PIV and smoke visualization. In the subcritical Re regime, the wake of a stationary dimpled sphere shows large-scale wavy structures and the hairpin-shaped vortices are shed changing its azimuthal orientation quasi-randomly in time. As Re increases from subcritical to critical regime, the recirculation bubble length decreases significantly and the drag coefficient reduces rapidly to about 0.23. The wavelength of wake also decreases and the shedding orientation of the hairpin-shaped vortices becomes fixed in time. In the supercritical regime, both the recirculation bubble length and drag coefficient remain almost constant, whereas the wavelength of wake decreases further. With rotation, the recirculation bubbles disappear at very small α in the critical and supercritical regimes, resulting in a faster increase in the lift coefficient with α than that in the subcritical regime.

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