Abstract Submitted
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Drag reduction on a circular cylinder by uniform and discrete blowing[1] ZHI WU, HAECHEON CHOI, Seoul National University — Vortex shedding occurs in the wake behind a bluff body when the Reynolds number exceeds a critical value, resulting in a significant drag increase. In this study, we apply uniform and discrete blowing, respectively, to flow over a circular cylinder at the Reynolds number of 20,000 for drag reduction. Two slits and two rows of nozzles are installed near the separation points (on the upper and lower surfaces) to realize uniform and discrete blowing, respectively. These uniform and discrete blowing are performed in steady and time-periodic modes, and their actuation amplitude and frequency are optimized systematically. Steady discrete blowing is much more effective and efficient in drag reduction than steady uniform blowing, providing maximum drag reduction of 52%. On the other hand, time-periodic, uniform and discrete blowing result in maximum drag reductions of 52% and 62%, respectively. With smoke-wire flow visualizations and PIV measurements, we show that counter-rotating vortices induced by optimal discrete blowing change the Kármán vortex cores into three-dimensional vortices and weaken their strength. Additionally, high-frequency blowing works better for sup-pressing the formation of the Kármán vortices than steady or low-frequency blowing.

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