Drag Reduction on a Circular Cylinder using Splitter Plates

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Abstract

Control of drag force on a circular cylinder using detached splitter plates is numerically studied for laminar flow. Two splitter plates with the same length as the cylinder diameter(d) are placed horizontally in the upstream of the cylinder and wake region respectively. Their positions are described by the gap ratio (G1/d, G2/d), where G1 represents the gap between the cylinder stagnation point and rear edge of the upstream splitter plate, and G2 represents the gap between the cylinder base point and the leading edge of the splitter plate placed in the wake region. The drag varies with the gap ratio; it has the minimum value at a certain gap ratio for each Reynolds number. Effective energy loss induced by the upstream splitter plate decreases the stagnation pressure, which causes the drag reduction on the cylinder. Furthermore, the downstream splitter plate suppresses vortex shedding past the cylinder leading to further reduction in drag force when it is placed within a certain critical distance from the cylinder base point. Particularly, the drag sharply increases past the critical G2/d; this seems to be related to the sudden change in bubble size in the wake region. This trend is consistent with the experimental observation currently available in the case of turbulent flow.

Keyword: *(drag reduction, circular cylinder, splitter plates, gap ratio*