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Drag optimization of a sphere using a wind-adaptive deformable structure

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ABSTRACT

The sphere is the simplest three-dimensional object and therefore there have been a lot of studies on the flow around it. In particular, various methods have been proposed to reduce the drag by deforming the surface of the sphere (Choi *et al*. 2008). These methods (e.g., installing dimples on the sphere surface) have the advantage of being able to reduce drag without energy input. However, there is a limitation in that a surface modification that reduces drag successfully in a specific wind speed range does not work in other wind speed ranges. This limitation is due to the fact that even if the wind speed changes, the size of the structure remains constant.
To overcome this limitation, this study devised a novel wind-adaptive deformable structure (called AMR (Adaptive Moving Ring)) for reducing drag optimally over a wide range of wind speeds (Chae *et al*. 2019). AMR is designed to decrease in size without power input as wind speed increases. In this study, the drag forces are measured for spheres with or without AMR through a wind-tunnel test and compared with each other. AMR with the spring constant tuned for the optimal performance reduces the drag up to 64% in the tested wind speed range. The flow mechanism by which AMR optimally reduces the drag of the sphere will be discussed in the presentation.

REFERENCES

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