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Numerical investigation of the wake flow control past a circular cylinder with Electrohydrodynamic actuator

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Abstract

A numerical analysis is carried out to investigate the wake flow control behind a circular cylinder with corona discharge. The electrohydrodynamic flow is utilized to suppress the boundary layer separation and modify the vortical structures of the flow past a circular cylinder. Numerical simulations consist of the interaction between the electric and flow fields. In this article, the finite volume approach is employed to simulate the flow affected by EHD actuator. The effects of applied voltage, shape of the grounded electrode, location and radius of the discharge electrodes on the swirling flow patterns and drag reduction have been studied. The Reynolds numbers are considered from 4000 to 16000. The results shown that, the modification in EHD actuator design can be used to enhance the flow control effects. The present achievements indicate that, EHD-induced flow can significantly reduce the wake flow behind a circular cylinder. Moreover, the study suggested that this actuator can be applied to practical separation suppression and drag reduction. Furthermore, the predicted numerical results are in excellent agreement with the experimental data.

Keywords

Electrohydrodynamic; Flow control; Wake flow; Circular cylinder; Numerical investigation.