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Numerical Analysis of Laminar Flow around Square Cylinders with EHD Phenomenon

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Abstract : In this research, a numerical simulation of an Electrohydrodynamic (EHD) actuator’s effects on the flow around a square cylinder by using a finite volume method has been investigated. This is one of the newest ways for controlling the fluid flows. Two plate electrodes are flush-mounted on the surface of the cylinder and one wire electrode is placed on the line with zero angle of attack relative to the stagnation point and excited with DC power supply. The discharge produces an electric force and changes the local momentum behaviors in the fluid layers. For this purpose, after selecting proper domain and boundary conditions, the electric field relating to the problem has been analyzed and then the results in the form of electrical body force have been entered in the governing equations of fluid field (Navier-Stokes equations). The effect of ionic wind resulted from the Electrohydrodynamic actuator, on the velocity, pressure and the wake behind cylinder has been considered. According to the results, it is observed that the fluid flow accelerates in the nearest wall of the frontal half of the cylinder and the pressure difference between frontal and hinder cylinder is increased.

Keywords : CFD, corona discharge, electro hydrodynamics, flow around square cylinders, simulation
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