

CONTROL OF SEPARATION OF AIR FLOW ALONG CYLINDER USING PLASMA ACTUATORS

The research aim is to develop an approach to modeling a dielectric barrier discharge when a plasma actuator is in a mobile continuous medium. Based on a physical model of the dielectric barrier discharge, the mathematical model describing the transient electric and aerodynamic processes in operation of the plasma actuator is built. A numerical algorithm for solving the equations of plasma electrodynamics and equations of a viscous incompressible flow, including turbulence, in curvilinear coordinates on moving grids for modeling the dielectric barrier discharge is developed using the control volume method. The possibility of reducing the drag coefficient of the cylinder is demonstrated using the plasma actuators by suppressing the Karman vortex street. The obtained results of the flow around a cylinder for the case of turned on/off plasma actuators agree closely with the experimental data. This approach is applicable to the simulation of the dynamics of the fluid flow and low-speed gas in the presence of an electrostatic field. The proposed technique takes into account the physical features of the class of problems under consideration and has a high computational efficiency.

Keywords: control of viscous liquid flow, numerical simulation, plasma actuator, dielectric barrier discharge, Navier-Stokes equations.

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