INVESTIGATION OF THE HEAT TRANSFER FROM OSCILLATING CYLINDER BY THE VVD METHOD

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The Viscous Vortex-Heat Domains (VVHD) method has been developed for numerical solving the 2D Navier-Stokes equations of the viscous heat-conductive incompressible flow. This method is the generalization of Viscous Vortex Domains (VVD) method [1] for the heat-conductive fluid. The temperature field is presented by heat particles (heat domains) which move with the velocity \( \mathbf{u} = \mathbf{V} + \mathbf{V}_d^{(T)} \), where \( \mathbf{V} \) is fluid velocity, \( \mathbf{V}_d^{(T)} \) is diffusion velocity of the heat domains \( \mathbf{V}_d^{(T)} = -a \nabla \ln(T - T_\infty) \). Such approach has been applied in [2]. But we use another discrete formulas for calculating \( \mathbf{V}_d^{(T)} \) than in [2]. The VVHD method allows to simulate the vorticity and temperature fields evolution more accurately than method suggested in [2], especially near surfaces. It is known [3] that there is correlation between vortex and heat fields [3] in separated flow around heated bodies. The VVHD method allows us to compute boundary layer with high resolution and to investigate this correlation.

The flows around oscillating circular cylinders have been studied by the VVHD method. Different types of oscillations have been considered to identify the relationship between drag coefficient and the coefficient of heat transfer.

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Fig. 1. (a) – Temperature fields near cylinder, performing longitudinal oscillations, \( Re = 200, Sh = 0.8, Pr = 1 \); (b) – empirical dependency \( \text{Nu}(Re) \) for static cylinder [4], compared to VVD method results. Red dot corresponds to Fig. 1a.

REFERENCES.