Near wall control and transport properties of two-dimensional vortex structures

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The talk presents the results of an investigation of the formation, stability and control of localized two-dimensional vortex structures near a curved rigid airfoil with respect to the drag reduction and the transport properties of passive admixtures. Low order models based upon classical discrete vortices embedded into an inviscid fluid are employed. The unsteady flow near the airfoil is modeled by a nascent point vortex of variable intensity satisfying the Kutta-Joukovskii condition during transient processes. Analytical and numerical studies of the problems of vortex interactions with micro-grooves and cavities (vortex chambers) are presented. Special attention is paid to the stationary equilibrium positions of vortices near a rigid body. Recommendations concerning optimal ways of trapped vortex control are given. In particular, the recommendations for optimal choice of positioning and intensity of vortex generators on the controlled surface are given. Numerical results of simulations of the transport processes in the near-wall zone, the determination of regions of low and high domains of passive admixtures are discussed. A special technique for the quantitative estimate of the quality of stirring properties is given.

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