Analytical and numerical simulation of the ascending swirling gas flows

Kazachinsky A O and Krutova I Y[@]

Snezhinsk Physics and Technology Institute of the National Research Nuclear University Moscow Engineering Physics Institute, Komsomolskaya Street 8, Snezhinsk, Chelyabinsk Region 456776, Russia

[@] IYKrutova@mephi.ru

An interesting phenomenon is quite common in nature—an ascending swirling stream of air. The relevance of the study is due to the fact that the study of ascending swirling flows not only makes it possible to reveal the mechanism of the emergence and functioning of these flows, but also leads to [1]: 1) predicting the occurrence of tornadoes and cyclones; 2) recommendations on methods for the destruction of such natural streams; 3) to recommendations for the practical use of the energy of natural ascending swirling flows. The report addresses issues related to the study of natural swirling updrafts. For the system of equations of gas dynamics taking into account the action of gravity and Coriolis [2], the existence and uniqueness of the solution of specific characteristic Cauchy problems of the standard form, modeling non-one-dimensional flows with a drain, an inflow, and near a heating cylinder, is substantiated. The fact of the absence of swirling is established if the rotation of the Earth around its axis is not taken into account in the initial initial-boundary value problem. Three-dimensional stationary flows of an ideal gas in the vicinity of an impenetrable horizontal plane under the action of gravity and Coriolis forces are approximately constructed by numerical methods, and their geometric, velocity and energy characteristics are determined [3].

[1] Bautin S P, Krutova I Y and Obukhov A G 2020 *Gas-dynamic theory of upward swirling flows* (Yekaterinburg: UrGUPS)
[2] Bautin S P and Krutova I Y 2019 *Analytical and numerical modeling of gas flows taking into account the action of the Coriolis force* (Yekaterinburg: UrGUPS)
[3] Kazachinsky A O and Krutova I Y 2016 *Construction of flows in the bottom part of ascending swirling flows as a solution to one characteristic Cauchy problem: Preprint* (Snezhinsk: publishing house SPTI NRNU MEPhI)