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IDENTIFICATION OF THE GAS PROPERTIES BY MEASURING THE HEAT FLOW

Abstract

Study the spatial distribution of the atmosphere, the gas characteristics of the environment, the meteorological situation analysis and other research in the scientific and practical purposes in interplanetary piloting are extremely urgent problem. The possibility of identifying parameters of the gaseous medium by means of specially installed sensors is obvious, however, the probability of accidents or hardware failure exists. Moreover, not every unit is equipped with these sensors. As a backup scenario or as an alternative opportunity to obtain information on the characteristics of the gas composition of the atmosphere, the problem of identification of the gaseous medium by measuring the heat flow is considered. We consider numerical solutions to identification of problem of the gas properties by measuring the heat flow near the critical point of the axisymmetric blunt body that is streamlined supersonic flow of a perfect gas. Three groups of parameters have been identified: thermodynamic properties of the gaseous medium, the transport properties of the gaseous medium, and conditions on the outer boundary of the boundary layer. In this particular work, the transport properties of the gaseous medium are studied as an object of identification. The identification problem is formulated in an extreme setting. For optimization we have used combination of the Nelder-Mead method and random restarts technique. It has been shown that the specifics of the structure of the set of points, for which we have that the value of the objective function is lower than the value specified by the noise level of the heat flow measuring, makes it possible to obtain a fairly accurate estimation of the identified parameters.