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**D. N. LAZUCHENKOV, N. M. LAZUCHENKOV**

# ESTIMATION OF PROBE MEASUREMENTS RELIABILITY IN A SUPERSONIC FLOW OF A FOUR-COMPONENT COLLISIONLESS PLASMA

*Institute of Technical Mechanics*
*of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine,*
*15 Leshko-Popel St., Dnipro 49005, Ukraine; e-mail: lazuch.dn@gmail.com*

The aim of this work is to estimate the reliability of extracting the plasma electron density and temperature and ionic composition from the current-voltage (I-V) characteristic of an isolated probe system with cylindrical electrodes. An earlier proposed mathematical model of current collection by the probe system at positive bias potentials and an arbitrary ratio of the electrode areas is analyzed. The model is supplemented with a formula that determines, with an accuracy of several percent, the value of the bias potential at which the probe is under the plasma potential and the I-V characteristic splits into a transition and an electronic region. The analytical dependence of the bias potential on the plasma parameters and the ratio of the electrode areas made it possible to formalize the procedures for determining and assessing the reliability of the extracted plasma parameters using the regions of their strongest effect on the collected probe current. Parametric studies of the effect of the plasma parameters on the probe current were carried out for conditions close to measurements in the ionosphere. The paper demonstrates the feasibility of partitioning the sought-for plasma parameters into the regions of their strongest and weakest effect on the probe current in the range of the bias potentials considered. The problem of plasma parameter identification is formulated on the basis of a comparison of the probe current and the measured I-V characteristic in the $L_2$ theoretical approximation. To each parameter there corresponds an objective function of its own, which differs in the domain of definition and the ratio of the electrode areas used in I-V characteristic measurements. Based on this formulation of the inverse problem in $L_2$, estimates of the reliability of identification of the parameters of a plasma with two ion species are obtained depending on the errors of the model and probe measurements. The results obtained may be used in ionospheric plasma diagnostics.

***Keywords***: *two species of plasma ions, isolated probe system with cylindrical electrodes, mathematical model of current collection, parametric identification, reliability of plasma parameter extraction.*

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