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NUMERICAL SIMULATION OF A SUPERSONIC FREE-MOLECULAR PLASMA FLOW AROUND A CHARGED CONDUCTING CYLINDER NEAR A CONDUCTING SURFACE

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By the example of a model problem, this paper considers the effect of neighboring conducting bodies on the collection of charged plasma particles by a conducting cylinder. The aim of the paper is to study the effect of a nearby conducting body on the collection of the ion current by a charged cylinder in a supersonic cross flow of a collisionless nonisothermal plasma. Based on the two-dimensional Vlasov–Poisson system, a supersonic free molecular plasma cross flow past an infinitely long cylinder–strip system was simulated. The problem was solved numerically by a finite-difference relaxation method with splitting by physical processes on nested grids. When calculating the electron-repulsing locally equilibrium self-consistent electric field, use was made of the Poisson–Boltzmann approximation with a model electron density distribution. The paper analyzes the pattern of free-molecular nonisothermal plasma flow past a conducting cylinder – conducting strip system and introduces numerical parameters that determine the features of flow past the body system under consideration and the current collection by the cylinder. The ion current to a charged cylinder in a cross flow was calculated as a function of the cylinder potential, the degree of plasma nonisothermality, and the position of the cylinder relative to a conducting surface whose potential is close to the floating one. The numerical simulation made it possible to find quantitative characteristics of the effect of a conducting surface on the collection of the ion current by a charged cylinder. The results may be used in the development of scientific and process diagnostic instruments that interact with a low-temperature rarefied plasma flow and in the design of structural elements for advanced spacecraft and space systems.

Keywords: *rarefied nonisothermal plasma flow, cross flow past a cylinder–strip system, Vlasov–Poisson system, splitting method, nested grids, calculation of the current to a cylinder near a conducting surface.*

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