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MATHEMATICAL MODEL FOR DETERMINING THE DESIGN PARAMETERS OF A DEORBIT SYSTEM'S AERODYNAMIC ELEMENTS

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The goal of this paper is to develop a mathematical model for choosing the design parameters of deorbit systems' aerodynamic elements. To solve the problem of near-Earth space debris, it is proposed to deorbit used space objects. Low-Earth orbits are most clogged. Aerodynamic systems are among the most promising systems for space debris removal from low-Earth orbits. They are quite reliable and cheap, but they are sensitive to exposure to space factors. In this paper, aerodynamic systems are decomposed to identify their hierarchic structure, which has the following levels: a subsystem level, an element level, and a parameter level. Materials for the structural components of an aerodynamic element are analyzed. A set of design parameters for aerodynamic systems is formed and used in the development of a mathematical model for choosing the parameters of an aerodynamic element for deorbit systems of various classes: monoblock ones, frame inflatable ones, ones formed by transforming the structure of a space object into an aerodynamic system, and telescopic ones. The material thickness determination model accounts for shell exposure to the space vacuum, atomic oxygen, and excess pressure. It also accounts for errors in determining the ballistic coefficient of an aerodynamic system with a space debris object to be deorbited, the solar activity index, and the atomic oxygen density. The mathematical model for aerodynamic system parameter choice allows one to construct nomograms for determining the parameters of deorbit systems for space debris objects of various classes from their mass and orbit parameters.

Keywords: *space object, deorbit system, aerodynamic element, set of design parameters, mathematical model.*

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