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AUTOMATIC RF ION THRUSTER ACCELERATED DEVELOPMENT CHAIN

Abstract

The modern space industry is undergoing rapid growth due to the commercialization of technology and the increase the market size involved in the area. In such a condition, the updating and improvement of satellite systems is more dynamic than before. In this regard, the development of satellite subsystems requires appropriate speeds and rates. Some products of the rocket industry, which today have become the most relevant, are traditionally developed for decades. For example, the development of an electric propulsion system for a spacecraft takes a very long time due to the use of the empirical method of optimization. However, the current development of computers and physical models that describe thruster processes can significantly accelerate the development and optimization of a new product by conducting numerical experiments, thereby reducing the time of experimental work, and therefore the cost of the product. As an object of study in this work, we considered an RF ion thruster for small satiates. The application and the number of tasks to be solved for such devices is currently growing, and this requires a larger margin of characteristic speed for their implementation. A large number of startups, companies and institutes around the world are developing electric propulsion for small satellites, but the cycle time is still significant. In the framework of this work, an attempt was made to solve the problem of developing and optimizing a RF ion thruster using an complex model and an automatic calculation chain. Using the pSeven program, the integration of all modules of the calculation chain was implemented and the relationships between each link were built. Using the built-in optimization tools, a series of calculation of engine characteristics was carried out for a large number of input parameters. Variable parameters were: dimensions and shape of the discharge chamber, the antenna parameters (frequency, current, resistance), type of working gas, and the ion-optical system characteristics. The results of the complex model and the optimization cycle were verified using the laboratory model of the RF ion thruster GT50 developed by “AVANT SPACE SYSTEMS LTD”. The result of the computational chain allows to evaluate the characteristics and optimize the regimes and configuration of the RF ion thruster of almost any size and for any inert gas. Using the chain will speed up the development cycle, search for optimal configurations of such devices, accelerate and reduce the cost of the development processes of a new product.