

Research of Acoustic Emitting Sources and Calculation of Their Characteristics During the Launch of the Space Rocket

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There are many different acoustic fields appear during the start of a space rocket in the atmosphere. Therefore, it is necessary to identify the features and determine the research directions of acoustic emitting at the start of a space rocket based on existing ideas about the generation and propagation of sound waves.

It is need to make an analysis of the relationship between the acoustic emitting source characteristics appeared at different times of the rocket launch and with the acoustic field characteristics. There is experimental checking, program and technique development for performing measurements of acoustic oscillation characteristics are important in carrying out research.

The active and passive acoustic effect suppression methods development is carried out at the stage of preliminary design. It is based on the results of the physical and mathematical analysis of acoustic oscillations sources.

It is important to calculate the amplitude-frequency characteristic of acoustic emitting. Knowledge of the emitting frequency of acoustic waves makes it possible to apply models of long-wave and short-wave emitting, known in classical acoustics. This is an important factor that gives an idea of the acoustic field direction and makes it possible to simplify the calculation of sound pressure magnitude as a function of distance variation from the source of oscillations to the point where the conditioned observer is located.

To create mathematical models designed to calculate the characteristics of acoustic fields, well known analytical methods with the use of Fourier series can be applied, as well as numerical simulation methods. Mathematical dependencies will allow us to analyze the relationship between the energy characteristics of acoustic emitting sources and the characteristics of their acoustic fields.

A general methodology of researching the acoustic emissions during the flight of a space rocket in the first 8 seconds of flight is developed. The source type of acoustic oscillations is considered. The acoustic fields from primary and secondary acoustic sources are considered. The models for calculating the acoustic characteristics in the first 8 seconds of the space rocket flight are proposed.

The methods for calculating the propulsion system noise are proposed, which make it possible to determine the sound pressure in the environment.

To calculate the acoustic characteristics of the volumetric type emitters, an algorithm and a program in the language of Java have been developed. For a model of acoustic emitting based on the Lamb potential, calculations were performed in the MathCad and Fortran software environments.

An analysis of the relationship between the acoustic emitting source characteristics and the acoustic fields characteristics is established. Also the calculation of the amplitude-frequency characteristic of acoustic emitting is given.