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Mathematical calculation of acoustic loads at launch of a rocket

The main tasks for solving this scientific work are the creation of scientific bases in the areas related to the definition of the type of acoustic radiation at the start of RKN, the development of physical models of acoustic fields, depending on the type of acoustic sources of radiation and the methods for calculating the characteristics of acoustic fields.

Acoustic fields analysis

At launch, rockets in the atmosphere arise from the diverse nature of the radiation acoustic fields. Therefore, it is necessary to identify the features and determine the direction of research acoustic radiation at the start of the RCP based on existing ideas about the generation and propagation of sound waves.

In a more general formulation of the problem, an analysis of the interconnection of the characteristics of sources of acoustic radiation that appear at different moments of the launch time of the rocket, with the characteristics of acoustic fields, should be conducted. In conducting research, important experimental testing, development of programs and techniques for measuring acoustic oscillation characteristics are important. In this case, the list of equipment necessary for the measurement of acoustic characteristics (devices, circuits, equipment) is made.

Based on the results of physical and mathematical analysis of sources of acoustic oscillations at the stage of sketching, development of active and passive methods of extinguishing acoustic influences is possible.

The frequency levels are given initial data, and constitute 31,5-8000 Hertz.

To calculate the characteristics of the sound, depending on the distance and distance from the sound source, the direction of focus characteristics, the number of harmonics at frequencies from 31.5 Hz to 8000 Hz on the software language Fortran written the program.

The program calculates the sound pressure p in Db at a point located at a distance r from the source of radiation, and also at an angle of the direction to the source θ.

Output data for calculation:

c - sound speed (c = 340 m / s)

R - thrust at the cut of the nozzle (R1 = 180833 R2 = 185232 R3 = 189673 R4 = 194240 R5 = 198875) [kgf],

θ is the angle of the orientation characteristic (θ = 0-180), ˚

r - distance from the source of radiation (r = 2-18) [m],

f - sound frequency (f = 31.5-8000) [Hz],

m is the harmonic number (m = 1-25).

In a separate array, the nominal values of the draft at the nozzle section Ri are recorded for a certain period of time (4-8) seconds, in the interval of time - 1 second. The value of the thrust of the engine is known and set in a separate array.

Based on the results of physical and mathematical analysis of sources of acoustic oscillations at the stage of sketching, development of active and passive methods of extinguishing acoustic influences is possible..

References

1. GI Sokol. On the impact of sound and infrasound acoustic vibrations on living organisms [Text] / G.I. Sokol, O.M. Duplishcheva, T.A. Fishing // Ecology and the noosphere - D., 2009. - Vol.20, No. 3-4. - P. 15 - 25..
2. Handbook of technical acoustics. // Heckl M., Müller H.A. (ed.). 1980- Shipbuilding. Leningrad. 1980.
3. Output data for work on the topic "Investigation of acoustic sources of radiation, their fields and methods of calculating their characteristics at the start of the RCP" in relation to the design of elements PU.11.5895.101.ID from 12.04.2017. - 23s.