Correlation and spectral analyses of electrophysical characteristics of hydrocarbon fuel exhaust products in a model liquid rocket engine

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The article presents the methodology and results of correlation and spectral analysis of electrophysical characteristics of kerosene and oxygen combustion products registered in the process of bench firing tests of the model liquid rocket engine (LRE) with the primary sensors of the electromagnetic field. Mathematical apparatus and techniques of secondary processing arrays of electromagnetic field characteristics were developed for the frequency correlation analysis in the range of 0…28 kHz of an operating condition - the pressure in the combustion chamber and a defined parameter — the magnetic field strength of the combustion products. It is found (with correlation coefficient 0.863) that the dependence of magnetic field strength of the combustion products beyond the nozzle on the pressure in the model LRE combustion chamber is close to linear. This dependence can be used as a diagnostic feature for creating a high-speed emergency LRE protection system.

Keywords*: liquid rocket engine, firing tests, diagnostics, electromagnetic field, correlation and spectral analyses*

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