
Experimental and theoretical study of combustor discharge from the double-nozzled gas generator

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The article considers the computational and experimental study results of condensed system combustor discharge from the double-nozzled gas generator, as well as mixing process of combustion products. Calculations are based on mathematical modeling of gas-dynamic flow in a three-dimensional way for viscous heat-conducting gas with condensed phase particles. The article analyses gas generator model experimental studies with the charge of energy condensed system of end burning. We used imaging techniques and luminance pyrometry while diagnosing combustor discharge from the gas generator nozzles. The study reveals the regularities of changes in discharged combustion products flow structure, and the gas-jets interaction processes at different pressures and at different diameters of nozzle critical sections in the gas generator.

Keywords: gas generator, energy condensed systems, combustor discharge, mathematical modeling, experimentation, visualization.

REFERENCES

- [1] Zhukov B.P., ed. *Energeticheskie kondensirovannye sistemy. Kratkiy ehntsiklopedicheskiy slovar* [Energy condensed systems. Concise encyclopedic dictionary]. Moscow, Yanus-K Publ., 2000, 596 p.
 - [2] Dobrovolskiy M.V. *Zhidkostnyye raketnyye dvigateli* [Liquid motors], Moscow, BMSTU Publ., 2016, 461 p.
 - [3] Vlasov Yu.N. *Inzhenerny vestnik — Engineering Bulletin*, 2012, no. 9. DOI: 77-48211/465812
 - [4] Sorokin V.A., ed. *Konstruktsiya i proektirovanie kombinirovannykh raketnykh dvigateley na tverdom toplive* [The construction and design of combined rocket engine on solid fuel]. Moscow, BMSTU Publ., 2014, 304 p.
 - [5] Frik P.G. *Turbulentnost: podkhody i modeli* [Turbulence: approaches and models]. Moscow, RHD Publ., 2010, 107 p.
 - [6] Sokolov B.I., Cherenkov A.S., Salomykov A.I. *Termodinamicheskie i teplofizicheskie svoystva tverdykh raketnykh topliviikh produktov sgoraniya* [Thermodynamic and transport properties of solid rocket fuels and their combustion products]. Moscow, Voenizdat Publ., 1977, 320 p.
 - [7] Voronetskiy A.V. *Nauka i obrazovanie — Science and Education*, 2016, no. 1. DOI: 10.7463/0116.0830993
 - [8] Yagodnikov D.A., Lapitskiy V.I., Sukhov A.V., Tomak V.I. *Inzhenerny Vestnik — Engineering Bulletin*, 2014, no. 11. Available at: <http://engbul.bmstu.ru/doc/743675.html> (accessed August 21, 2016).
 - [9] Yagodnikov D.A., Khomyakov I.I., Burkov A.S., Artyukhova O.A. *Vestnik MGTU im. N.E. Baumana. Seria Mashinostroenie — Herald of Bauman Moscow State Technical University, Series: Mechanical Engineering*, 2014, no. 3, pp. 101–109. Available at: <http://vestnikmach.ru/catalog/powgen/hidden/488.html> (accessed August 16, 2016).
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