Determining the optimal location of fuel tanks of the rocket, designed on a “tandem” scheme, with minimum starting weight

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The research studied optimal arrangement of rocket fuel tanks of minimum starting weight with preserving the stability. We paid the main attention to calculating the strength and stability of the tank shells, determining their thickness in the two layout options: oxidizer – fuel, fuel – oxidizer. First, we calculated the weight of the obtained structure in both cases, analyzed the extension of centre of pressure and centre of mass. Then, we made a comparison of the weight value obtained from the strength calculation, with the value adopted in the statistics design. Moreover, we proposed a solution to the problem of static rocket instability by installing lattice stabilizers and we showed the advantage of the obtained design in a weight ratio. Finally, we proved the benefits of placing the oxidizer tank behind the fuel tank, which makes it possible to create lighter rockets and increase the payload mass without increasing the general product weight.

Keywords: *tank, weight coefficient, fuel, arrangement, voltage, oxidant, lift, tension, oxidizer, lift force, strength, extension of centre of pressure and centre of mass, carrier-rocket, compressive force, stabilizer, starting weight, shell thickness, fuel compartment, stability.*

REFERENCES

[1] Baslyk K.P., Generalov N.N., Kuleshov B.G. *Inzhenerhyy zhurnal: nauka i innovatsii — Engineering Journal: Science and Innovation,* 2013, no. 7 (19). Available at: http://engjournal.ru/catalog/machin/rocket/849.html (acceessed September 22, 2014).

[2] Baslyk K.P., Generalov N.N., Kuleshov B.G. *Nauka i obrazovanie — Science and Education,* 2014, no. 10. DOI 10.7463/1014.0728843

[3] Mishin V.P., Bezverbyy V.K., Pankratov B.M. *Osnovy proektirovaniya letatelnykh apparatov (transportnye sistemy)* [Fundamentals of aerial vehicles (transport systems) design]. Moscow, Mashinostroenie Publ., 1985, 360 p.

[4] Dobrovolskiy M.V. *Zhidkostnye raketnye dvigately* [Liquid rocket engines]. Moscow, BMSU Publ., 2005, 488 p.

[5] Balabukh L.I., Alfutov N.A., Usyukin V.I. *Stroitelnaya mekhanika raket* [Structural rocket mechanics]. Moscow, Vysshaya shkola Publ., 1984, 391 p.

[6] Feodosiev V.I. *Osnovy tekhniki raketnogo poleta* [Fundamentals of rocket flight technique]. Moscow, Nauka Publ., 1979, 496 p.

[7] Belotserkovskiy S.M., Odnovol L.A., Safin Yu.Z. *Reshetchatye krylya* [Lattice wings]. Moscow, Mashinostroenie Publ., 1985, 320 p.

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