Parameter optimization of solar battery multilink construction with rope disclosure system

© A.Yu. Bushuev, B.A. Farafonov

Bauman Moscow State Technical University, Moscow, 105005, Russia

The main purpose of the research is to choose optimal parameters of rope disclosure system that ensure specified fixation succession of a multilink construction. The selection of these parameters is done on the basis of the mathematical model analysis. We used the criterion of least squares as an optimization indicator: mismatch of relative angles of link rotation, calculated by the model and specified as solar battery assembling conditions. Moreover, we took into account extra angle of rotation caused by rope deformation. In this way, we obtained rope tensions from the solar battery disclosure ground test which was carried out on the hovercraft stand.

Keywords: *mathematical model, rope disclosure system, multilink construction, solar battery, optimization.*

REFERENCES

[1] Bakunin D.V., Borzykh S.V., Ososov N.S., Shchiblev Yu.N. *Matematicheskoe modelirovanie — Mathematical modeling*, 2004, no. 6, vol. 16, pp. 86–92.

[2] Ilyasova I.G. *Vestnik Samarskogo Gosudarstvennogo Aerokosmicheskogo Universiteta im. akademika S.P. Koroleva — Vestnik of the Samara State Aerospace University,* 2012, no. 4 (35), pp. 88–93.

[3] Krylov A.V., Churilin S.A. *Vestnik MGTU im. N.E. Baumana. Seriya Mashinostroenie — Herald of Bauman Moscow State Technical University. Ser. Mechanical Engineering*, 2011, no. 1, pp. 106–111.

[4] Yudintsev V.V. *Polet – The Flight*, 2012, no. 5, pp. 28–33.

[5] Kuznetsova A.O. *Vestnik Sibirskogo gosudarstvennogo aerokosmicheskogo universiteta im. akademika M.F. Reshetneva — Vestnik SibGAU*, 2005, no. 3, pp. 135–138.

[6] Panichkin V.I. *Izvestiya AN SSSR. MTT — Mech. Solids*, 1992, no. 4, pp. 183–190.

[7] Yudintsev V.V. *Dinamika sistem tverdykh tel* [Dynamics of solid bodies systems]. Samara, Samara State Aerospace University Publ., 2008.

[8] *Roy Featherstone Rigid Body Dynamics Algorithms*. Springer Science+Business Media, LLC, 2008.

[9] Aslanov V., Kruglov G., Yudintsev V. Newton–Euler equations of multibody systems with changing structures for space applications. *Acta Astronautica*, 2011. doi: 10.1016/j.actaastro.2010.11.013

[10] Narayana B.L., Nagaraj B.P., Nataraju B.S. Deployment Dynamics of Solar Array with Body Rates. *Materials of International ADAMS User Conference,* 2000.

[11] Bushuev A.Yu., Farafonov B.A. *Matematicheskoye modelirovaniye i chislennye metody – Mathematical Modeling and Computational Methods*, 2014, vol. 2, no. 2 (2), pp. 101–114.

[12] Mengali G., Salvetti A., Specht B. *Multibody Analysis of Solar Array Deployment using Flexible Bodies*. Universita di Pisa. Facoltà di Ingegneria, Corso di Laurea in Ingegneria Aerospaziale, 2007.

[13] Efanov A.M., Kovalevskiy V.P. *Teoriya mehanismov i mashin* [Theory of mechanisms and machines]. Orenburg, Orenburg State University Publ., 2004.

[14] Chichinadze V.K. *Reshenie nevypuklyh nelineynykh zadach optimizatsii (Metod preobrazovaniya)* [Solution of non-linear non-convex optimization problems (Method of conversion)]. Moscow, Nauka Publ., 1983.
[15] Dimitrienko Yu.I. *Mekhanika sploshnoi sredy. Tom 4. Osnovy mekhaniki tverdogo tela* [Mechanics of continua. Vol. 4. Fundamentals of solid mechanics]. Moscow, BMSTU Publ., 2013, 624 p.
[16] DimitrienkoYu.I., Drogolub A.N., Gubareva E.A. *Nauka i obrazovaniye. Elektronnoe izdanie — Science and education. Electronic Journal,* 2015, no. 2. doi: 10.7463/0215.0757079

Bushuev A.Yu. (b. 1951) graduated from Bauman Moscow Higher Technical School in 1974 and Lomonosov Moscow State University in 1985. Cand. Sci. (Eng.), Assoc. Professor of the Computational Mathematics and Mathematical Physics Department at Bauman Moscow State Technical University. Specialist in the field of applied mathematics.
e-mail: a.ju.bushuev@.yandex.ru

Farafonov B.A. (b. 1993), student of the Aerospace Department at Bauman Moscow State Technical University. Research interests include mathematical modelling and optimization.