
Methodological approaches to solving problems of large-scale spacecraft constellation control

© M.M. Matyushin, N.L. Sokolov, V.M. Ovechko

FSUE Central Research Institute of Machine Building, Korolev town, 141070, Russia

Analysis of advanced projects of space exploration shows that the main developmental trend in the global space activity should include a significant expansion of spacecraft groups of different types and purposes, the complication of missions, focus on the deep space research. It predetermines the necessity of solving qualitatively new tasks primarily related to the establishment of efficient space infrastructure. The article discusses new methodological approaches to the research of particular aspects of the large-scale spacecraft constellation control problems. In particular, there is a description of approaches to optimization of allocation of ground facilities for spacecraft control, to optimization of control complex structures, to the development of rational model for the flight information operative control.

Keywords: *spacecraft, spacecraft constellation, control, methodological approach, space infrastructure, ground facilities, structural optimization.*

REFERENCES

- [1] Soloviev V.A., Lysenko L.N., Lyubinskiy V.E. *Upravlenie kosmicheskimi poletami. Ch. 1, 2* [Space Flight Control. Parts 1, 2]. Moscow, BMSTU Publ., 2009, 912 p.
 - [2] Lubinskiy V.E., Soloviev V.A. *Polet – Flight*, 2005, no. 6, pp. 3–6.
 - [3] Vanin A.V., Voronov E.M., Karpunin A.A. *Vestnic MGTU im. N.E. Baumana. Seriya Estestvennyye nauki – Herald of the Bauman Moscow State Technical University. Series: Natural Sciences*, 2012, no. 6, pp. 19–42.
 - [4] Bagdasaryan A.G. Obshchaya struktura informatsionnoy ekspertnoy sistemy modelirovaniya i analiza slozhnykh ierarkhicheskikh sistem v konture upravleniya. Upravlenie bolshimi sistemami. [A General Structure of Information Expert System for Simulation and Analysis of Complex Hierarchical Systems in Control Loop. Control of Large-Scale Systems]. *Trudy Instituta problem upravleniya RAN* [Proc. of the Institute of Control Sciences, RAS], 2008, no. 21, pp. 58–70.
 - [5] Ivanov V.M., Nosova C.R. Optimization methodology of hierarchical control of orbital constellations. *Proceedings of the 15th International Conference on Automatic Control, Modeling & Simulation (ACMOS '13). Series: Recent Advances in Electrical Engineering*. Brasov, Romania, June 1–3, 2013, pp. 32–36.
 - [6] Sokolov N.L. *Optimization methodology of hierarchical control of orbit groups*. Lambert academic publishing, 2014, 70 p.
 - [7] Gavrilut A., Croitoru A. Fuzzy multisubmeasures and applications. Advanced topics on fuzzy systems. *Proceedings of the 9th WSEAS International conference on FUZZY SYSTEMS (FS '08)*. WSEAS Press Publ., Sofia, Bulgaria, 2–4 May 2008, pp. 113–119. Available at: www.wseas.org.
 - [8] Podinovskaya O.V., Podinovskiy V.V. *Problemy upravleniya – Management Problems*, 2014, no. 6, pp. 2–8.
 - [9] Matyushin M.M. *Kosmonavtika i raketostroenie – Cosmonautics and Rocket Engineering*, 2007, no. 1(46), pp. 144–153.
 - [10] Bulekbaeva K., Brener A., Turalina M. Relaxation models of competing manufactures dynamics. *13th International Conference on Systems Theory and Scientific Computation “Recent advances in systems theory, signal processing and*
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computation” (ISCGAV '13, ISTASC '13). Valencia, Spain, August 6–8, 2013, pp. 147–151.

Matyushin M.M. (b. 1974) graduated from Bauman Moscow State Technical University in 1997. Dr. Sci. (Eng.), Deputy General Director – Head of the Mission Control Center, Central Research Institute of Machine Building. Author of over 40 research publications. Research interests: system analysis, design of spacecraft control systems. e-mail: mccm@mcc.rsa.ru

Sokolov N.L. (b. 1951) graduated from Moscow State Forest University in 1974. Cand. Sci. (Eng.), Head of the Department, Central Research Institute of Machine Building. Author of over 70 research publications. Research interests: ballistics, flight mechanics, spacecraft optimal control. e-mail: sokolov@mcc.rsa.ru

Ovechko V.M. (b. 1950) graduated from Leningrad Institute of Aviation Instrument in 1974. Deputy Head of the Department, Central Research Institute of Machine Building. Author of over 15 research publications. Research interests: system analysis, spacecraft flight dynamics and control. e-mail: ovm-mps@yandex.ru
