On the problem of designing thermal protection structures

© A.Ju. Bushuev

Bauman Moscow State Technical University, Moscow, 105005, Russia

In this paper we propose a method for determining a combination of layer thicknesses ensuring the predetermined maximum allowable temperature at the layer boundaries provided that the number of variable layers is not equal to the number of controlled points. We present a numerical example of solving the problem of designing a three-layer structure subject to bilateral heating, with the requirement that the maximum temperature of the construction inner layer should not exceed 1073 K. This requirement is satisfied by varying the thickness of the outer thermal insulation layers. The solution obtained by using the developed method, asymptotically approaches the optimal solution in extreme setting of the problem.

Keywords: *thermal designing, composite thermal protection structures, optimal solution.*

REFERENCES

[1] Mikhaylov V.V. Inzhenerno-Fizicheskii Zhurnal – Journal of Engineering Thermophysics, 1980, vol. 39, no. 2, pp. 286–291.

[2] Bushuev A.Ju., Timofeev V.N. Inzhenernyi zhurnal: nauka i innovatsii — Engineering Journal: Science and Innovations, 2012, iss. 2. Available at: http://engjournal.ru/articles/53/53.pdf

[3] Bushuev A.Ju., Gorskiy V.V. Inzhenerno-Fizicheskii Zhurnal – Journal of Engineering Thermophysics, 2000, vol. 73, no. 1, pp. l55–159.

[4] Bushuev A.Ju., Gorskiy V.V. Inzhenerno-Fizicheskii Zhurnal – Journal of Engineering Thermophysics, 1991, vol. 61, no. 6, pp. 1014–1018.

[5] Dimitrienko Yu.I., Fedonyuk N.N., Gubareva E.A., Sborshchikov S.V., Prozorovskiy A.A. Nauka i obrazovanie. Elektronnoe nauchno-tekhnicheskoe izdanie – Science and Education. Electronic Scientific and Technical Journal, 2014, no. 7. URL: http://technomag.bmstu.ru/doc/717805.html. DOI: 10.7463/0714.0717805

[6] Dimitrienko Yu.I., Yakovlev N.O., Erasov V.S. , Fedonyuk N.N., Sborshchikov S.V., Gubareva E.A., Krylov V.D. , Grigoryev M.M., Prozorovskiy A.A. Kompozity i nanostruktury – Composites and Nanostructures, 2014, no. 1, vol. 6, pp. 32–48.

[7] Dimitrienko Yu.I., Efremov G.A., Chernyavsky S.A. Optimal Designing of Erosion-Stable Heat-Shield Composite Materials. Int. Journal of Appl. Composite Materials, 1997, vol. 4, no. 1, pp. 35–52.

[8] Dimitrienko Yu.I., Koryakov M.N. , Balakshin A.I. Nauka i obrazovanie. Elektronnoe nauchno-tekhnicheskoe izdanie – Science and Education. Electronic Scientific and Technical Journal, 2013, no. 10. DOI: 10.7463/1013.0606069

[9] Dimitrienko Yu.I., Drogolyub A.N., Sokolov A.P., Shpakova Yu.V. Nauka i obrazovanie. Elektronnoe nauchno-tekhnicheskoe izdanie – Science and Education. Electronic Scientific and Technical Journal, 2013, no. 11. DOI: 10.7463/1113.0621065

[10] Himmelblau D.M. Applied Nonlinear Programming. McGraw-Hill Book Company, 1972.

Bushuev A. Ju. (b.1951) graduated from Bauman Moscow Higher Technical School in 1974, Lomonosov Moscow State University in 1985. Ph.D., Assoc. Professor of the Computational Mathematics and Mathematical Physics Department at Bauman Moscow State Technical University. Author of more than 20 scientific works. Scientific interests: mathematical simulation in technology, the methods of optimization and decision making, numerical methods. e-mail: a.ju.bushuev@ya.ru