ROCKET-SPACE DEVICE ENGINEERING AND INFORMATION SYSTEMS
2025, Vol. 12, Iss. 1, pp. 22–29

UDC 623.592 EDN KBHOFH

Design Features of Optical Systems of Mounted Simulators for Testing Angle Measuring Devices for Spacecraft Orientation

A.Ya. Gebgart, *Cand. Sci. (Engineering), info@geofizika-cosmos.ru*
Research and production enterprise "Geofizika-Cosmos", Moscow, Russian Federation
M.P. Kolosov, *Dr. Sci. (Engineering), info@geofizika-cosmos.ru*
Research and production enterprise "Geofizika-Cosmos", Moscow, Russian Federation

Abstract. The paper considers the design features of optical systems of mounted simulators for testing angle measuring devices for spacecraft orientation operating by the Sun, Earth and stars. Recommendations for their design are provided. The optical design drawings of a number of mounted simulators and their optical specifications are presented. The materials of the paper can be useful for developers of equipment for testing and control of spacecraft angle measuring devices.

Keywords: optical systems, lens, mounted simulator, collimator

For citation: Gebgart A.Ya., Kolosov M.P. Design Features of Optical Systems of Mounted Simulators for Testing Angle Measuring Devices for Spacecraft Orientation. *Rocket-Space Device Engineering and Information Systems.* 2025. Vol. 12. No. 1. P. 22–29.

References

1. Gebgart A.Ya., Kolosov M.P. *Optika priborov oriyentatsii kosmicheskikh apparatov* [Optics of spacecraft orientation devices]. Moscow, Universitetskaya kniga. 2017. 152 p. (in Russian)

2. Kolosov M.P., Gebgart A.Ya. Opticheskiye sistemy sovremennykh staticheskikh priborov oriyentatsii kosmicheskikh apparatov [Optical systems of modern static spacecraft-orientation devices]. *Opticheskiy zhurnal* [Journal of Optical Technology], 2017, No. 84, No. 12, pp. 3-10. (in Russian)

3. Pirogov M.G., Varlamov V.I., Tsymbal G.L. et al. Pribory oriyentatsii kosmicheskikh apparatov po Solntsu na osnove matrichnykh priyemnikov izlucheniya s aktivnymi pikselami [Instruments for spacecraft orientation with respect to the Sun based on active-pixel detector arrays]. *Opticheskiy zhurnal* [Journal of Optical Technology], 2017, Vol. 84, No.12, pp. 18-24. (in Russian)

4. Cheremukhin G.S. *Pribory oriyentatsii na solntse dlya kosmicheskikh apparatov* [Solar orientation devices for spacecraft]. Moscow, Voentekhizdat. 2004, 384 p. (in Russian)

5. Kolosov M.P., Gebgart A. Ya., Lobanov D.Yu. et al. Opticheskaya sistema malogabaritnogo shirokougol'nogo solnechnogo datchika [Optical system of a miniature wide-angle solar sensor]. *Opticheskiy zhurnal* [Journal of Optical Technology], 2020, No. 87, No. 6, pp. 66-72. (in Russian)

6. Karpova V.A., Shchekin A.M. Perspektivnyy avtonomnyy malogabaritnyy solnechnyy datchik na osnove fotopriyemnogo ustroystva so vstroyennymi algoritmami obrabotki izobrazheniya [Perspective autonomous small-size solar sensor based on photodetector with built-in image processing algorithms]. *Tezisy sed'moy vserossiyskoy nauchno-tekhnicheskoi konferentsii "Sovremennyye problemy oriyentatsii i navigatsii kosmicheskikh apparatov"* [Abstracts of the Seventh All-Russian Scientific and Technical Conference "Modern Problems of Orientation and Navigation of Spacecraft"]. Russia, Tarusa, 2021. Moscow, IKI RAS. pp. 269-272. (in Russian)

7. Fedoseyev V.I., Kolosov M.P. *Optiko-elektronnyye pribory oriyentatsii i navigatsii kosmicheskikh apparatov* [Optical-electronic devices for orientation and navigation of spacecraft]. Moscow, Logos. 2007, 247 p. (in Russian)

8. Kogan L.M. Moshchnyye izluchayushchiye diody infrakrasnogo diapazona [Power infrared diodes]. *Elektronika: NTB* [Electronics: STB] 2011, No. 8, pp. 66-73. (in Russian)

9. Pirogov M.G., Varlamov V.I., Gordyakin V.V. et al. Pribor oriyentatsii po Zemle dlya infrakrasnogo diapazona spektra na osnove mikrobolometricheskoy matritsy [Infrared microbolometer array-based Earth-oriented attitude sensor]. *Opticheskiy zhurnal* [Journal of Optical Technology], 2017. Vol. 84, No. 11, pp. 22-28. (in Russian)

10. Avanesov G.A., Voronkov S.V., Dunayev B.S., et al. Imitatory zvezdnogo neba dlya nayemnoy otrabotki datchikov zvezdnoy oriyentatsii [Star sky simulators for mercenary practicing of stellar orientation sensors]. *Sbornik trudov vserossiyskoy nauchno-tekhnicheskoi konferentsii "Sovremennyye problemy opredeleniya oriyentatsii i navigatsii kosmicheskikh apparatov"* [Proceedings of the All-Russian Scientific and Technical Conference "Modern Problems of Orientation Determination and Navigation of Spacecraft"]. Russia, Tarusa, 2008. Moscow, IKI RAS. pp. 372-386. (in Russian)

11. Available at: http://www.iki.cosmos.ru. (in Russian)

12. Available at: http://www.optotekhnika.ru. (in Russian)

13. Available at: http//www.jena-optronik.de. (in Russian)

14. Baranov P.S., Mantsvetov A.A. Dinamicheskiy imitator zvezdnogo neba [Dynamic simulator of the star sky]. *Tezisy dokladov 13-y m/n konferentsii "Televideniye: peredacha i obrabotka izobrazheniy"* [Theses of reports of the 13th m/n conference "Television: image transmission and processing]. Sankt-Peterburg, 2016, pp. 231-236. (in Russian)

15. Ivanov V.A., Levko G.V., Morozov A.V., Popova K.A., Chirkunova A.A. *Imitator zvezdnogo neba* [Star sky simulator]. Patent RF na poleznuyu model' No. 155206 [Russian Federation patent for utility model No. 155206]. (in Russian)

16. Rusinov M.M. *Kompozitsiya opticheskikh sistem* [Composition of optical systems]. L.: Mashinostroyeniye. Leningr. otdeleniye. 1989, 383 p. (in Russian)

17. Nikolayev I.D., Angelov P.P. Ob"yektivy s vynesennym zrachkom [Lenses with a projected pupil]. *OMP*, 1980, No. 12, pp. 13-15. (in Russian)

18. Zverev V.A., Serebryakov A.G. Bazovyye skhemy opticheskikh sistem s vynesennym zrachkom [Basic schemes of optical systems with a rendered pupil]. *Opticheskiy zhurnal* [Optical Journal], 2000, Vol. 67, No. 6, pp. 74-77. (in Russian)

Received ***22.01.2025***
Accepted ***24.02.2025***