Asymptotic methods for solving the problems of diffraction on DOE

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Abstract

The study presents a new asymptotic method for solving the problem of diffraction on diffractive optical elements with band structure. The method includes a rigorous solution of the diffraction task on a periodic structure with a period comparable to the wavelength, and a geometrical optical approach. The solution of the diffraction task was developed on a reference quasi-periodic structure combining the functions of a diffraction grating and a diffraction lens. Based on the solution of the reference task, a simple approximation is developed for the field immediately behind the diffraction element.

Keywords: field near the microrelief, Helmholtz equation, integro-differential equation, reference structure of DOE, generalization of the reference solution, geometrical optical approach.

[Access full text (in Russian)](#)

References

[1] Kravtsov YuA, Orlov YuI. Geometrical optics of inhomogeneous media. Berlin, Heidelberg: Springer-Verlag; 1990. ISBN: 978-3-642-84033-3.

[2] Moharam MG, Gaylord TK. Rigorous coupled-wave analysis of metallic surface-relief gratings. J Opt Soc Am A 1986; 3(11): 1780-1787. DOI: 10.1364/JOSAA.3.001780.

[3] Taflove A, Hagness S. Computational electrodynamics: The finite-difference time-domain method. 2nd ed. Boston: Artech House Publishers; 2000. ISBN: 978-1-58053-076-7.

[4] Ilinski AS, Kravtsov VV, Sveshnikov AG. Mathematical modelling in electrodynamics [In Russian]. Moscow: "Vyschaya Shkola" Publisher; 1991.

[5] Born M, Wolf E. Principles of optics: Electromagnetic theory of propagation, interference and diffraction of light. 6thed. New York: Pergamon Press, 1980. ISBN: 978-0-08-026482-0.

[6] Vinogradova MB, Rudenko OV, Sukhorukov AP. The theory of waves. Moscow: "Nauka" Publisher; 1990.

[7] Fedoruk MV. Asymptotics, integrals and series [In Russian]. Moscow: "Nauka" Publisher; 1987.

[8] Petit R, ed. Electromagnetic theory on gratings. Berlin, Heidelberg, New York: Springer-Verlag, 1980. ISBN: 978-3-642-81502-7.

[9] Golub MA, Doskilovich LL, Kazansky NL, Soifer VA, Kharitonov SI. Computer generated diffractive multi-focal lens. J Mod Opt 1992; 39(6): 1245-1251. DOI: 10.1080/713823549.