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Transformation of a Symmetrical TM Mode at the Open End of Cylindrical Waveguide with Dielectric Loading

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Electromagnetic radiation with terahertz frequencies (0.1-10 THz) is supposed to be a promising tool for a number of applications. Efficient terahertz emission can be achieved, for example, using the beam-driven dielectric loaded structures [1]. Under certain approximations, the problem of transformation of a single TM mode with a high number at the open end of a cylindrical waveguide with a dielectric layer was considered recently [2]. Namely, radiation patterns in the Fraunhofer zone were calculated using rigorous Stratton-Chu formulas, but the field at the outer side of the open end aperture was calculated using Kirchhoff approximation and Fresnel coefficients formalism. In this report, we investigate the applicability of approximations utilized above by considering the rigorous problem statement. We develop the method known for solution of corresponding problem in plane geometry [3] and apply it to the case of cylindrical geometry. This technique is combination of the Wiener-Hopf technique and tailoring technique which leads to the infinite linear system for magnitudes of reflected modes. This system can be solved numerically using the reduction technique.

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Author: GALYAMIN, Sergey (Saint Petersburg State University)

Co-authors: TYUKHTIN, Andrey (Saint Petersburg State University); VOROBEV, Viktor (SaintPetersburg State University)

Presenter: GALYAMIN, Sergey (Saint Petersburg State University)

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