Opt Quant Electron (2013) 45:797–812
DOI 10.1007/s11082-013-9695-z

Analysis of the elliptic-profile cylindrical reflector with a non-uniform resistivity using the complex source and dual-series approach: H-polarization case

Taner Oğuzer · Ayhan Altıntaş · Alexander I. Nosich

Received: 9 October 2012 / Accepted: 8 May 2013 / Published online: 17 May 2013

Abstract An elliptic-profile reflector with varying resistivity is analyzed under the illumination by an H-polarized beam generated by a complex-source-point (CSP) feed. The emphasis is done on the focusing ability that is potentially important in the applications in the optical range related to the partially transparent mirrors. We formulate the corresponding electromagnetic boundary-value problem and derive a singular integral equation from the resistive-surface boundary conditions. This equation is treated with the aid of the regularization technique called Riemann Hilbert Problem approach, which inverts the stronger singular part analytically, and converted to an infinite-matrix equation of the Fredholm 2nd kind. The resulting numerical algorithm has guaranteed convergence. This type of solution provides more accurate and faster results compared to the known method of moments. In the computations, a CSP feed is placed into a more distant geometrical focus of the elliptic reflector, and the near-field values at the closer focus are plotted and discussed. Various far-field radiation patterns including those for the non-uniform resistive variation on the reflector are also presented.

Keywords Electromagnetic scattering · Method of analytical regularization · Optical devices

1 Introduction

The scattering of electromagnetic waves by the partially transparent thin curved scatterers, made up of lossless and lossy dielectric materials or imperfect metals, occupies a remarkable

T. Oğuzer (✉)
Electrical and Electronics Engineering Department, Dokuz Eylul University, Buca, 35160 Izmir, Turkey
e-mail: taner.oguzer@deu.edu.tr

A. Altıntaş
Department of Electrical and Electronics Engineering, Bilkent University, 06800 Ankara, Turkey

A. I. Nosich
Institute of Radio-Physics and Electronics NASU, Kharkiv 61085, Ukraine