PROCEEDINGS OF THE 1995 ELECTRONICS SOCIETY CONFERENCE OF IEICE

EiC 電子情報通信学会
1995年 エレクトロニクスソサイエティ大会
講演論文集 1

一 般 講 演

C-1. 電 磁 界 理 論　C-3. 光 エ レ ク ト ロ ニ ク ス
C-2. マイクロ波 A, B, C.　C-4. レーザ・量子エレクトロニクス

シンポジウム

SC-1. 光加入者方式用デバイスの開発状況
SC-2. 限界に挑戦する半導体光素子

1995年 9 月 5 日～ 8 日　中央大学理工学部（東京都文京区）
September 5～8, 1995, CHUO UNIVERSITY, TOKYO

ELECTRONICS SOCIETY
THE INSTITUTE OF ELECTRONICS, INFORMATION AND COMMUNICATION ENGINEERS
社団法人 電子情報通信学会
エレクトロニクスソサイエティ

C-22

Analytical-Numerical Approach for the Solution of the Diffraction by a Resistive Strip – Part II: The Case of *E* Polarization

Eldar I. Veliev†, Kazuya Kobayashi‡, Shoichi Koshikawa‡ and Takahiro Ueki‡

†Institute of Radiophysics and Electronics, Ukrainian Academy of Sciences, Kharkov 310085, Ukraine
‡Department of Electrical and Electronic Engineering, Chuo University, Tokyo 112, Japan

The problem of diffraction by resistive and impedance strips has received much attention recently [1] since these structures are important in the radar cross section (RCS) reduction of targets. In Part I [2] of this two-part paper, we have analyzed the plane wave diffraction by a resistive strip for the H polarization using the analytical-numerical approach [3]. In this second part, we shall treat the diffraction by the same geometry for the E-polarized plane wave incidence based on the method similar to that employed in Part I. The time factor is assumed to be $e^{-i\omega t}$ and suppressed in the following.

The geometry of the resistive strip is shown in Fig. 1, where $E_z^i\,[=e^{-ik(x\cos\theta+y\sin\theta)}]$ is the incident field with k being the free-space wavenumber. The total field satisfies the boundary condition [4]

$$E_z(x,+0)=E_z(x,-0)=-\frac{\zeta Z}{2}[H_x(x,+0)-H_x(x,-0)] \quad (1)$$

for $|x|<a$, where ζ is the resistivity and Z is the intrinsic impedance of free space. The scattered field E_z^s $(\equiv E_z-E_z^i)$ has the integral representation

$$E_z^s(x,y)=\frac{1}{4i}\int_{-a}^{a}J_E(x')H_0^{(1)}(k\sqrt{(x-x')^2+y^2})dx', \quad (2)$$

where $H_0^{(1)}(\cdot)$ denotes the Hankel function of the first kind and $J_E(\cdot)$ is the unknown current density function. In view of the edge condition [4] for a resistive half-plane, we may express the current density function in terms of the Gegenbauer polynomial $C_n^{1/2}(\cdot)$ as

$$J_E(\eta)=\sum_{n=0}^{\infty}J_n^E C_n^{1/2}(\eta), \quad |\eta|<1, \quad (3)$$

where $\eta=x/a$, and J_n^E for $n=0,1,2,\cdots$ are the unknown coefficients. These coefficients are determined numerically by solving the infinite system of linear algebraic equations (SLAE)

$$-\zeta J_m^E=\gamma_m^E+\sum_{n=0}^{\infty}A_{mn}^E J_n^E, \quad m=0,1,2,\cdots, \quad (4)$$

where γ_m^E and A_{mn}^E are known coefficients. Applying the saddle point method in (2) and using (3) together with the solution of (4), the far field asymptotic expression of E_z^s will be derived.

Figure 2 shows a numerical example of the normalized total scattering cross section (SCS) $\sigma/4a$ as a function of normalized frequency ka for $\theta=90°$, $\zeta=0.1-i0.27$. The results of a perfectly conducting strip ($\zeta=0$) have also been included to investigate the effect of resistivity. We observe that the total SCS is reduced for the case of a resistive strip over the whole frequency range shown in the figure. Comparing the results in Fig. 2 with the corresponding ones for the H polarization [2], the SCS reduction due to the resistivity at low frequencies is more significant in the E-polarized case than in the H polarization.

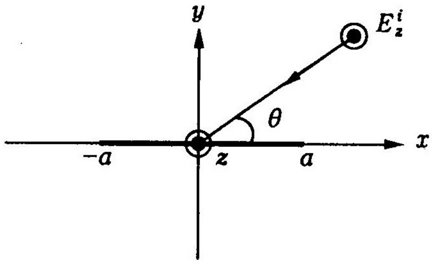

Fig. 1. Geometry of the problem.

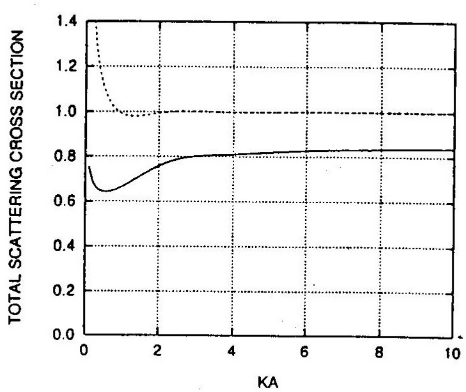

Fig. 2. Frequency dependences of the total scattering cross section $\sigma/4a$ for $\theta=90°$. ——— : $\zeta=0.1-i0.27$; ·········· : $\zeta=0$.

Acknowledgment

This work was supported in part by the Institute of Science and Engineering, Chuo University.

References

[1] M. I. Herman and J. L. Volakis, *Radio Sci.*, vol. 22, no. 3, pp. 335–349, 1987. [2] E. I. Veliev, K. Kobayashi, S. Koshikawa and N. Shimada, to be presented at *The 1995 Society Conference of IEICE*, September 5–8, 1995. [3] E. I. Veliev and V. V. Veremey, in *Analytical and Numerical Methods in Electromagnetic Wave Theory*, Chap. 10, M. Hashimoto, M. Idemen, O. A. Tretyakov, Eds., Scenice House, Tokyo, 1993. [4] I. M. Braver, P. Sh. Fridberg, K. L. Garb and I. M. Yakover, *IEEE Trans. Antennas Propagat.*, vol. AP-36, no. 12, pp. 1760–1768, 1988.