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High Frequency Scattering by a Thick Conducting Plate With Multiple Holes –E Polarization Case–

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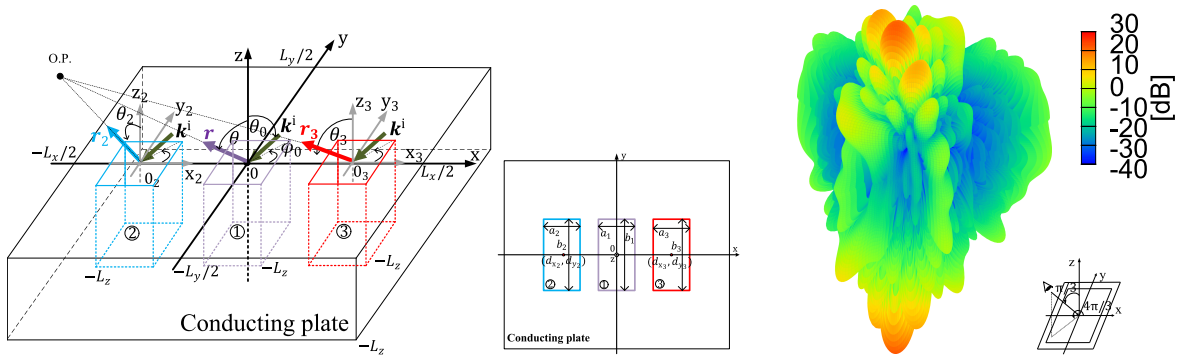
With the expansion of wireless communications, predicting the high-frequency electromagnetic wave scattering fields near buildings is necessary to provide an adequate quality of service for subscribers in an urban area. The scattering by a building surface with multiple windows may be estimated from the corresponding value by a thick conducting plate with multiple holes. In this study, based on a success of the Kirchhoff Approximation (KA) method in other works [1, 2], a closed form of the scattering far-field by a thick conducting plate with holes has been found for the transverse electric (TE) polarized plane wave incidence. The KA method postulates equivalent magnetic currents on virtually closed surfaces on the holes and the exterior of the plate from the incident plane wave and successive interaction fields in the holes. Then, the scattering field can be obtained from the radiation integrals due to these currents. If the distance between the holes is large compared with the wavelength, and the coupling effect among the holes becomes weak, the scattering field of multiple holes may be obtained by superpositioning the previously derived result for a single hole [1].

In order to show the validity of our formulation, the scattering by a plate with three holes is used as in Fig. 1(a). Figure 1(b) shows the corresponding three-dimensional scattering pattern. Comparable results are also calculated by other methods such as the Finite element method (FEM), and the Physical optics (PO) method. A good agreement has been found to confirm the validity of our method. Detail comparison among the different methods and polarization difference will be shown in the presentation.



(a) 3D model and Top view **(b)** 3D pattern E_ϕ

Figure 1. (a) A thick conducting plate with three holes. (b) 3D E_ϕ pattern by the conducting plate with three holes viewing from $\theta = \pi/3, \phi = 4\pi/3$. $\theta_0 = \pi/6$, $\phi_0 = \pi/4$. $kL_x = kL_y = 50$, $kL_z = 2$. $ka_1 = ka_2 = ka_3 = 10$, $kb_1 = kb_2 = kb_3 = 20$. $kd_{x_1} = 0$, $kd_{x_2} = -kd_{x_3} = 15$, $kd_{y_1} = kd_{y_2} = kd_{y_3} = 0$.

References

[1] K. N. Nguyen, H. Shirai, and H. Serizawa, "Electromagnetic scattering analysis from a rectangular hole in a thick conducting screen," *IEICE Transactions on Electronics*, **E104-C**, 4, April 2021, pp. 134–143, doi:10.1587/transele.2020REP0001.

[2] C. M. Bui, K. N. Nguyen, and H. Shirai, "Electromagnetic wave scattering analysis by a window aperture on a conducting wall," *Progress In Electromagnetics Research C*, **122**, August 2022, pp. 95–108, doi:10.2528/PIERC22041501.