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Impedance Wedge Diffraction at Skew Incidence

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Scattering of a plane wave at skew incidence by an impedance wedge is a challenging diffraction problem. Special cases for which exact solutions have been found are listed in [1]. Unfortunately, the important case of two equal face impedances has an exact solution only when the wedge reduces to a half-plane.

Recently, the Wiener-Hopf (W-H) technique has been extended to wedge problems [2]. In this paper we apply this technique to the problem of equal face impedance and arbitrary wedge angle. The W-H formulation [2] of the impenetrable wedge problem in general yields kernel matrices of order four. The symmetry of this particular problem reduces the order of the kernel matrix and we are concerned with the factorization problem of second-order matrices that have the canonical form

$$G(\alpha) = \begin{vmatrix} 1 & a(\alpha) \\ b(\alpha) & 1 \end{vmatrix}.$$

Since the ratio $a(\alpha)/b(\alpha)$ is not a rational function of α, the matrix $G(\alpha)$ is not of the Daniele-Khrapkov type and no method of exact factorization is known in this case. However, the rational approximant of the function $\sqrt{a(\alpha)/b(\alpha)}$,

$$\sqrt{\frac{a(\alpha)}{b(\alpha)}} = \frac{n(\alpha)}{p(\alpha)},$$

where $n(\alpha)$ and $p(\alpha)$ are polynomials in α, provides an efficient factorization of $G(\alpha)$, which leads to an accurate evaluation of the diffraction coefficients present in this problem.

REFERENCES

1. Senior, T. B. A. and J. L. Volakis, "Approximate boundary conditions in electromagnetics," The Institution of Electrical Engineers, London, United Kingdom, 1995.
2. Daniele, V.G., "The Wiener-Hopf technique for impenetrable wedges having arbitrary angles apertures," *SIAM Journal of Applied Mathematics.*