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Scattering of a TE Mode by Cylindrical Posts of Different Cross Sections Located Inside a Parallel-Plate Waveguide

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The scattering of a TE mode propagating inside a parallel-plate waveguide by a cylindrical post located inside the waveguide and oriented perpendicularly to the waveguide plates is analyzed, in the phasor domain and with a time-dependence factor exp(+jωt) omitted throughout. The primary mode has zero electric field component in the direction of propagation of the mode and in the direction of the generators of the cylindrical post. A similar analysis for the case of a TM mode was recently presented at a conference.

Three different shapes of the cross-sectional area of the post are considered: circular, elliptical, and segment (corresponding to a flat strip as a limiting case of a post of elliptical cross section). The analysis consists of three steps. First, a propagating mode is decomposed into the sum of two plane waves that are obliquely incident on the cylindrical post. Second, the scattering of each plane wave by a post of infinite length is determined. Third, it is verified that the superposition of the two scattered fields yields an overall scattered field that satisfies the boundary conditions on the two plates of the waveguide.

Exact solutions are obtained for metallic posts of all three cross-sectional shapes. For a circular cylindrical post, a solution is also given when the post is made of a linear, homogeneous and isotropic material characterized by arbitrary values of scalar permeability and permittivity. For a penetrable post of elliptical cross-section, a solution is obtained when the linear, homogeneous and isotropic material of the post is either isorefractive or anti-isorefractive to the surrounding medium. Numerical results are presented and discussed.

1 A. Arora, M.D. Poort and P.L.E. Uslenghi, "Scattering by cylindrical posts of various cross sections located inside a parallel-plate waveguide", *Digest of National Radio Science Meeting*, Boulder, Colorado, Jan. 2018.