

Analysis of a Slot Pair on a Corrugated Waveguide of Finite Length and Extraction of its Coupling Factor

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We extract the coupling factor of a circularly polarized slot pair on an infinitely-long corrugated waveguide by analyzing it on a finite-length corrugated waveguide as shown in Fig.1 and eliminating the reflections at both ends of the finite-length corrugated waveguide connecting regular waveguides, because we cannot analyze the slot pair on the infinitely-long corrugated waveguide directly. The analysis will be used for designing a radial line slot antenna with corrugations as slow-wave structure to suppress grating lobes.

Fig.1 shows the analysis model. A finite number of corrugations and a slot pair are cut on a rectangular waveguide with periodic boundary walls in the narrow walls to simulate uniform excitation of the slot pairs arrayed in the transverse direction in a parallel plate waveguide. Another rectangular waveguide with two sets of periodic boundary walls is placed in the external region to simulate uniform excitation of a two-dimensional array of the slot pairs. The number of the corrugations should be large enough not to couple higher-order evanescent modes with the slot pair. The model includes not only the coupling of the slot pair but also the reflections at both ends of the corrugation array. Therefore, the scattering matrix at the end should be derived at first by analyzing only the corrugations together with Deschamps method (G.A.Deschamps, J. Appl. Phys., 24, 8, 1046-1050, 1953). Secondly, the corrugations and the slot pair are analyzed with incident waves from the both sides with proper ratio including the scattering matrix derived in the previous step so that the dominant propagating mode is incident to the slot pair only from one direction in the corrugated region. The analysis predicts the scattering factors to the two regular waveguides. Finally, the coupling factor of the slot pair on the infinitely-long waveguide can be extracted by using the scattering factors in the second step and the scattering matrix in the first step again. The numerical results will be shown in the presentation.

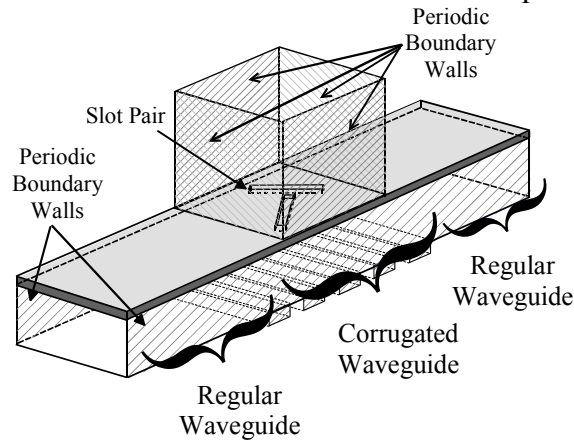


Fig.1 Analysis Model