Array of Slot Pairs in a Rectangular Waveguide for Omnidirectional Radiation

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Omnidirectional antennas are used in applications such as Wideband Local Area Networks, and amateur radio microwave beacons and repeaters. Longitudinal slot pairs cut in both broad walls of a rectangular waveguide produce very nearly omnidirectional radiation in the E-plane (Takeshima, Electronic Engineering, pp. 617-621, Oct. 1967). The length and offsets of both slots in a pair are identical but they are located in opposite walls. Adjacent slot pairs have alternating offsets with respect to the center lines of broad walls so as to have in phase radiation from a standing wave array such as that shown in the figure below.

Because of symmetry both slots have identical excitations. We have developed method of moments (MoM) solutions to the integral equations of the apertures of a slot pair and also for a linear array of slot pairs, by simple modification of previous analyses of a single slot and array of single slots respectively. Since each slot pair is modeled as single equivalent shunt admittance in a transmission line, the well-known Elliott design procedure is applicable to an array of slot pairs. Some design examples of linear array of slot pairs will be discussed in the presentation. The performance characteristics such as the input reflection coefficient, radiation pattern, and gain of these arrays will be determined by the MoM solutions. Uniform geometrical theory of diffraction is used to discuss the omni-directionality of the pattern as a function of waveguide height. The external mutual coupling between slots on the opposite sides is neglected in the analysis and design of these arrays since such coupling involves double diffractions, from two edges. In addition, simulations of the arrays by CST Microwave Studio will be presented. Efficient and accurate MoM analysis of the array may be used with a global optimization technique such as the genetic algorithm.
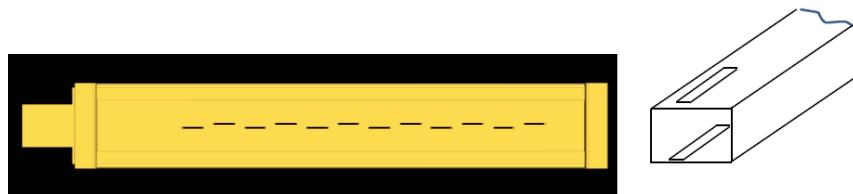

Figure 1 Linear array of slot pairs for omnidirectional pattern