HIGHER ORDER MODE COUPLING BETWEEN COUPLING SLOTS IN A PLANAR SLOT ARRAY

Sembiam R. Rengarajan[1,2]
[1]Department of Electrical and Computer Engineering, California State University, Northridge, CA 91330-8346
[2]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Abstract Submission Form

2004 National Radio Science Meeting

Abstract: rengarajan14317

Date Received: September 24, 2004

Waveguide-fed planar slot arrays generally consist of a feed waveguide for each sub-array. The feed waveguide excites a number of radiating waveguides stacked next to each other. Longitudinal offset slots are cut in the broadwall of radiating waveguides so as to obtain the desired radiation. The excitation of radiating waveguides is facilitated by centered-inclined coupling slots cut in the common broadwall between the feed waveguide and each radiating waveguide. In the design of slot arrays the coupling slots are modeled as series elements in equivalent transmission lines. In the prior literature it has been shown that ignoring the higher order mode coupling may result in significant errors in the excitations of radiating waveguides, especially when coupling slots have small values of tilt angles and/or the spacing between adjacent slots in the order of 0.6 free space wavelength (Rengarajan, IEEE Trans. Microwave Theory Tech., vol. 39, 7, pp. 1219-1222, 1991). Presently there exists a technique that includes the higher order mode coupling between adjacent longitudinal slots in the radiating waveguides (Elliott and OLoughlin, IEEE Trans. Antennas Prop., vol. 34, pp. 1149-1154, 1986).

In this paper we propose a method to account for the higher order mode coupling between adjacent coupling slots. Initially the design of the planar slot array is carried out without including the higher order mode coupling between coupling slots. In this design all the coupling slot tilts and lengths are such that they are resonant. Subsequently we account for the higher order mode coupling between adjacent coupling slots and perturb the values of the slot lengths and tilts so that they have the required resonant excitations. Using this perturbation procedure we are able to perform a fast optimization whereas an optimization technique employing a full wave moment method program would be extremely inefficient. The design algorithm is validated by a full wave moment method analysis.

1. (a)
Sembiam Rengarajan
Dept. of Electrical and Compute
California State University
18111 Nordhoff Street
Northridge, CA
91330-8346 USA
srengarajan@csun.edu

(b) 818-677-3571

(c) 818-677-7062

2. B - Fields and Waves

3. (a)

4. C - Contributed Paper

5. No special instructions