Design Procedure of Two-Dimensional Slotted Waveguide Antenna Arrays with Controllable Sidelobe Level Ratio for High Power Microwave Applications

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Abstract

This paper presents a complete design procedure, with an optimized feeding method, of two-dimensional slotted waveguide antenna arrays (2D SWAs). For a desired sidelobe level ratio, the proposed system provides a pencil shape pattern with a narrow halfpower beamwidth, large sidelobe level ratio (SLR), and very low sidelobe levels (SLL), which makes it suitable for high power microwave applications. The radiating slotted waveguide antennas use longitudinal slots, designed for a specified slidelobe level ratio and resonance frequency. The resulting two-dimensional slotted waveguide antenna array is formed by stacking a number of similarly designed radiating SWAs, and fed with an additional SWA. The proposed feeding method uses longitudinal coupling slots rather than the conventional inclined coupling slots, which can provide better values of SLR and easily obtain very low SLLs, in comparison with the conventional systems. The feeder dimensions and slots positions are deduced from the dimensions and total number of the radiating SWAs. For a desired SLR, the slots excitation in the radiating and feeder SWAs are calculated based on a specified distribution. Then, using simplified closed-form equations and for a desired resonance frequency, the slots lengths, widths, and their distribution along the length of the radiating SWAs and feeder SWA can be found. Two examples are illustrated with different number of slots and radiating elements, and one is fabricated and tested. Chebyshev distribution is used to estimate the excitations of the SWA slots in the examples. The obtained measured and simulated results are in accordance with the design objectives.

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