Abstract :

New approaches for the determination of the radiation characteristics of planar arrays are proposed. Conventionally, the best compromise directivity-side lobes level is achieved using Dolf-Chebyshev amplitude distribution. However, classical distribution forms present disadvantages in calculation time, possibility in analyzing larger arrays and the array factor is only optimum in the two principle planes. To overcome these problems, the excitation amplitudes are written under the modal form. The obtained radiated fields compared with measurement results validate the technique. It is also shown that square arrays provide improved performances from point of view of directivity compared to those of rectangular arrays with comparable size. However, above specific array size, the directivity saturates. For this, another modification of the array factor of Chebyshev square array is proposed. The modification preserves the radiation pattern configuration (same number of null radiation directions and sidelobes) and improves both directivity and side lobe levels. Analytical expressions of the array factor, the directivity, maximum half-power beamwidth, and the maximum spacing between elements have been derived. It has been shown that the use of this new technique results in an improved directivity with respect to the classical Chebyshev for a square arrays identical in size, element spacing, direction of the main lobe and side lobes level.