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GEOMETRICAL THEORY OF DIFFRACTION

SUPACHEAT PREMPOONWATTANASUK : A THEORETICAL STUDY OF THE EFFECTS OF DIFFRACTION ON THE PERFORMANCE OF THE SINGLE PARABOLIC REFLECTOR ANTENNA SYSTEM. THESIS ADVISOR : CHATCHAI WAIYAPATTANAKORN, Ph.D.
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This research has the objective of studying the effects of diffraction at the reflector rim on the performance of the single parabolic reflector antenna system eg. the far-field pattern, co-polarization, cross-polarization, gain and efficiency using a GTD based technique and the planewave spectrum concept in the analysis.

It is found that the effect of edge diffraction causes ripples on the amplitude and phase distribution of the aperture field which result in lobe structure and null position distortion of the far-out sidelobes. For the near-in sidelobes the distortion is not significant. The distortion appears on both the co-polar and cross-polar gain patterns. Besides the axial gain, aperture efficiency and antenna efficiency all deteriorate.

The variation of the antenna system's parameters affects the influence from edge diffraction. It is shown that as the electrical size and edge taper increase, the edge diffraction effects decrease. This is evident from the reduction of ripples on the amplitude and phase distributions of the aperture field. In addition the lobe structure and null position distortion will occur at further angular position and the reduction of the axial gain, aperture efficiency and antenna efficiency tend to decrease. When the f/D ratio decreases, the edge effects also decrease. In the case of the offset reflector antenna with varying feed angle, the reduction of the axial gain and aperture efficiency decrease when the feed angle increases. The plot of the antenna efficiency reduction against the feed angle is similar to a skewed bell shape.

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