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COUPLING EFFECTS IN MULTIBEAM
REFLECTOR ANTENNAS

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SUMMARY

New results and conceptual design principles concerning multiple beam reflector antennas in which coupling effects are of major influence on antenna performance are presented.

Special attention is paid to a certain class of feeds consisting of minimum scattering antennas (MSA's). The mutual impedance between two identical MSA's is expressed as an integral over their power patterns including complex angles [1]. For a given element spacing power patterns that minimize mutual coupling may be found. However, the patterns which lead to minimum coupling may not be optimum when the illumination of the reflector is considered. This is accounted for by constraining the efficiency for a given f/D-ratio.

As an example of circularly polarized feed antennas detailed numerical analysis of coupling between arbitrarily oriented crossed dipoles is presented. In evaluating the scattered field from crossed dipoles the feeding network is included since a crossed dipole is never an MSA.

The secondary field pattern is calculated by a two-dimensional Romberg-integration of the complex current distribution on the reflector found by the physical optics approximation and contour plots of gain and polarization loss are discussed. Also the scattered near field in the focal region is calculated in order to evaluate coupling between feed elements due to the presence of the reflector.

Finally examples for coverage of specific areas on earth from a synchronous orbit satellite are presented.

[1] W. Wasylkiwskyj and W.K. Kahn, "Theory of mutual coupling among minimum-scattering antennas", IEEE Trans. AP-18, March 1970, pp. 204-215.