

THE UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
Radiation Laboratory

ANTENNA ARRAY RESEARCH

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This is the semi-annual report on Grant NGR 23-005-477 and covers the period from July 1 through 31 December 1972.

During this period a theoretical investigation of the properties of an inhomogeneous dielectric spherical antenna was started. The model used is a Luneberg lens excited by dipole source adjacent to the surface. The solution was also formulated for the more practical Huygen's source. The analysis involves confluent Hypergeometric functions and other non-tabulated functions. The computation of such functions especially for lens dimensions large compared to the operating wavelength is not straightforward. This work is proceeding satisfactorily, but is not yet complete. It is for dimensions large compared to the wavelength that we expect a better performance, especially lower side-lobes, compared to 'comparable' homogeneous lenses.

In order to investigate a more general type of inhomogeneity and possibly lens configurations other than spherical, the problem of field representation in inhomogeneous media was investigated. The field, in a source free region, was written in terms of two Hertz vectors in a curvilinear orthogonal coordinate system and conditions on the inhomogeneity leading to representation of the field in terms of two scalars were found. The effect of the source on the analysis will be investigated during the next phase of the research.

Since in dealing with inhomogeneous media the analysis involves the solution of differential equations for untabulated functions. Methods used for computing such functions were reviewed and generalized in order to simplify the computational effort. A paper based on this investigation was presented at the URSI/G-AP Meeting held in Williamsburg, Virginia on December 11-15, 1972. A technical report was prepared near the end of

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December entitled "On Electromagnetic Field Problems in Inhomogeneous Media". Copies of this report were forwarded to NASA in January.