Efficient Technique For Holographic Imaging Diagnostic To Antennas In Cylindrical Near-Field Scanning

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The theoretical basis of near-field measurement is the application of the surface equivalence theorem. The knowledge of the tangential fields on a surface that completely encloses the antennas enables the determination of the field in the region exterior to that surface. Among the near-field scanning geometries are planar, cylindrical, and spherical. The measurement in these coordinate system are possible since the vector wave equations are Sepal able. The Jet f'repulsion Laboratory has designed and built a cylindrical near-field measurement facility for the calibration of spaceborne radar antennas (Ref. Z. A Hussein and Y. Rahmat-Samii "On The Accurate Calibration Of The SeaWinds Rack Antenna: A Cylindrical Near-1 'ield Measurement AppI-each" *1 996 Proc. Int. Geosci. Remote Sensing Symp*). In this paper, an efficient technique for constructing the fields on a planar surface from the knowledge of the ncaI-field on a cylindrical surface for holographic diagnostic to antennas is presented. The formulation is based on cylindrical wave expansion and the method of steepest descent to obtain the far-field. in the implementation, however, a careful numerical integration is carried out such that far field observation points arc calculated at desired locations. Subsequently, the fields at these locations arc used to construct the near-field on arbitrary planar surface (s) via inverse FFT. Hence, this technique facilitates efficient and rapid computations of the near-field cm a planar surface not necessarily parallel to the aperture plane of the test antenna, and without resorting to interpolation on far-field observation points. Hence, a careful holographic diagnostic of a test antenna can be carried out. As an illustration of this method, simulation examples to determine the defective elements of planar array antennas arc presented.