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NUMERICAL ANALYSIS OF DIELECTRIC BODIES OF ARBITRARY SHAPE AND INHOMOGENEITY IN THE ELECTROMAGNETIC FIELD

Ph.D. Dissertation

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Abstract: In the thesis, a novel, general entire-domain moment-method is proposed for the analysis of lossy-dielectric bodies of arbitrary shape and inhomogeneity in the electromagnetic field. The bodies can be isolated or electrically coupled with arbitrary wire antennas. The approximation of geometry is performed by means of so-called trilinear hexahedrons. This is a body with straight edges and curved sides, completely defined by its eight vertices, which can be positioned in space arbitrarily. The hexahedrons, theoretically, may be of arbitrary electrical size. The equivalent electric displacement vector is approximated by 3D polynomials in local parametric (generally non-orthogonal) coordinates satisfying automatically the continuity condition for its normal component over shared sides of hexahedrons. The unknown current coefficients are determined by a Galerkin solution of the volume two-potential integral equation. The method is very accurate, efficient and reliable, enabling the analysis of up to electrically medium-sized dielectric scatterers or wire/dielectric antennas on even standard PC's. Numerical results are in excellent agreement with the results obtained by available methods. However, the proposed method requires much less unknowns (for at least an order of magnitude), and consequently very much reduced CPU time and memory requirements when compared with the existing, subdomain, methods.

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