EE 710: Numerical Methods in Electric and Magnetic Field Analysis (3-0-0:3)

Introduction to electromagnetic fields: Vector analysis, Electrostatics, Magnetostatics, Time varying electric and magnetic fields, Maxwell's equations &boundary conditions, Orthogonal Coordinate System, Initial value problem, Boundary value problem.

Finite Difference Method (FDM): Finite Difference schemes, Finite differencing of Parabolic, Hyperbolic and Elliptic PDEs, treatment of irregular boundaries, accuracy and stability of FD solutions, Application, Limitations and Error analysis.

Finite Element Method (FEM): Overview of FEM, Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, Solution of Poissons equation, efficient finite element computations, Application, Limitations and Error analysis.

Charge simulation method (CSM): Matrix equation of simulated charges, Matrix equation in homogeneous dielectrics, Governing equation subject to dirichlet & Neumann boundary conditions, Matrix form of poisons equation, Commonly used simulated charges e.g. point charge, line charge, ring charge, Application, Limitations and Error analysis.

Boundary Element method (BEM): Boundary element equation, method of weighted residual, green's theorem, variational principle, Matrix formulations of the boundary integral equation, Matrix form of posisson's equation, Matrix equation of axisymmetric problems,Application, Limitations and Error analysis.

References

1. P. Zhou, Numerical Analysis of Electromagnetic Fields, Springer
2. S. Chakroborty, Electric Field Analysis, CRC Press.
3. M. N. O. Sadiku, Numerical techniques in electromagnetics, CRC Press.
4. J. Bastos, N. Sadowski, Electromagnetic Modeling by Finite Element Method, CRC Press.
5. M. V. K. Chari and S. J. Salon, Numerical methods in electromagnetism, Academic Press.