Course Name - Electrical Equipment and Machines: Finite Element Analysis

Faculty Name - Prof. Shrikrishna V. Kulkarni

Institute Name - IIT Bombay

Course Syllabus -

Week 1: Introduction to the course need for finite element analysis , Analytical Vs Numerical techniques for solving Partial Differential Equations (PDEs) , Revisiting important concepts in electromagne tics - 1 , Revisiting important concepts in electromagneti cs - 2 , Magnetic vector potential
Week 2: PDEs in low frequency electromagnetics , Theory of eddy currents , Variational calculus and energy minimization approach , Variational approach to solve PDEs , Whole domain approximation
Week 3: Tutorial , Sub domain approximation , 1D FEM , Scilab code for 1D FEM – Tutorial , Error distribution
Week 4: 2D FEM – Formulation and shape functions , 2D FEM – Formation of global coefficient matrix, 2D FEM – Boundary conditions and solution , Scilab code – 2D FEM , Gmsh based freeware meshing
Week 6: Tutorial on 1D and 2D FEM , Solution of diffusion equation (time - harmonic problems) , Application: bar – plate , eddy current problem Eddy current loss in windings , Induction motor: torque – speed characteristics
Week 7: Axisymmetri c problem , Permanent magnets – Theory , Permanent magnets – FE analysis , Current fed solid conductors: FE Theory , Skin and proximity effects in windings
Week 8: Voltage fed stranded conductors: FE theory and applications , FEM for rotating machines: periodic boundary conditions, calculation of slot inductance of an induction motor , Force computations : J×B, stress tensor, and virtual work methods , FE analysis for force computations , Voltage fed circuit-field coupled transient analysis: inrush current computation