E5 212 Jan 3:0

Computational Methods in Electrostatics

Instructor

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Teaching Assistant

Email:

Department: EE

Course Time: 2:00 - 3:30 PM

Lecture venue: HV Lecture Hall

Detailed Course Page:

Announcements

Brief description of the course

Insulation engineering is fundamental to design of any electrical apparatus. It involves two steps, in which, evaluation of the electric field arising under various operating contingencies forms the basic step. This subject however is scarcely dealt in academia and also in practicing engineering, which is being addressed in this course.

This course is covers all the essential aspects of the fields in electrical insulation, the associated governing fields and boundary conditions. After an introduction to analytical methods and their limitations, it delves into three different numerical methods, namely, the finite difference method, charge simulation method and the finite element method. Simple codes on each of these methods are presented.

Prerequisites

Knowledge on basic electrostatic is desirable (but not essential)

Syllabus

Laplaceâ€™s and Poissonâ€™s equations in insulation design, transient fields due to finite conductivity, method of images, images in two-layer soil, numerical methods, finite difference, finite element and charge

simulation methods tutorials and demonstration on PC. Programming assignments.

Course outcomes

The outcome of the course are:

1. Clear understanding on the governing electric fields under various operating contingencies

2. Comprehensive knowledge on the three commonly employed numerical methods for electrical insulation

3. Basic aspects of the computer program development for these methods

4. Practical aspects of field computation and its interpretation/usage

Grading policy

Assignments : 30

Two tests: 20

Final exam: 50

Assignments

1. Paper assignment on the method of images

2. Computer code development for the finite difference method to solve for one dimensional non-linear or space charge dominated problem.

3. Computer code development for preparing and assembling FEM matrices for a 2D problem (with basic functions being provided by the instructor)

OR Solve a specified problem in a free FEM package

4. Computer based assignment to solve for a 2D electrostatic problem using the charge simulation method

Resources

Sadiku M N O, Numerical Techniques in Electromagnetics, Second Edn, CRC Press.
Weber E, Electromagnetic Fields, Dover, 1951.
Silvester P P and Ferrari R L, Finite Elements for Electrical Engineers, Cambridge University Press, 1996.
Selected journal papers.