

CHAPTER OVERVIEW

5: Electrostatics

Electrostatics is the theory of the electric field in conditions in which its behavior is independent of magnetic fields, including

- The electric field associated with fixed distributions of electric charge
- *Capacitance* (the ability of a structure to store energy in an electric field)
- The *energy* associated with the electrostatic field
- *Steady current* induced in a conducting material in the presence of an electrostatic field (essentially, Ohm's Law)

The term “static” refers to the fact that these aspects of electromagnetic theory can be developed by assuming sources are time-invariant; we might say that electrostatics is the study of the electric field at DC. However, many aspects of electrostatics are relevant to AC, radio frequency, and higher-frequency applications as well.

5.1: Coulomb's Law

5.2: Electric Field Due to Point Charges

5.3: Charge Distributions

5.4: Electric Field Due to a Continuous Distribution of Charge

5.5: Gauss' Law - Integral Form

5.6: Electric Field Due to an Infinite Line Charge using Gauss' Law

5.7: Gauss' Law - Differential Form

5.8: Force, Energy, and Potential Difference

5.9: Independence of Path

5.10: Kirchoff's Voltage Law for Electrostatics - Integral Form

5.11: Kirchoff's Voltage Law for Electrostatics - Differential Form

5.12: Electric Potential Field Due to Point Charges

5.13: Electric Potential Field due to a Continuous Distribution of Charge

5.14: Electric Field as the Gradient of Potential

5.15: Poisson's and Laplace's Equations

5.16: Potential Field Within a Parallel Plate Capacitor

5.17: Boundary Conditions on the Electric Field Intensity (E)

5.18: Boundary Conditions on the Electric Flux Density (D)

5.19: Charge and Electric Field for a Perfectly Conducting Region

5.20: Dielectric Media

5.21: Dielectric Breakdown

5.22: Capacitance

5.23: The Thin Parallel Plate Capacitor

5.24: Capacitance of a Coaxial Structure

5.25: Electrostatic Energy

Thumbnail: Electric field lines due to a point charge in the vicinity of PEC regions (shaded) of various shapes. (CC BY SA 4.0; K. Kikkeri).

Contributors and Attributions

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