School of Electrical, Computer and Energy Engineering

Ira A. Fulton Schools of Engineering

Arizona State University

EEE 643

Advanced Topics In Electromagnetic Radiation, Scattering and Communication

Text: ***Advanced Engineering Electromagnetics (2nd Edition)*** by Constantine A. Balanis

References:

Geometrical Theory of Diffraction for Electromagnetic Waves by G. L. James
Numerical and Asymptotic Techniques in Electromagnetics by R. Mittra
Computer Techniques for Electromagnetics by R. Mittra
Antenna Theory: Analysis and Design by C. A. Balanis
Time-Harmonic Electromagnetic Fields by R. F. Harrington

Course Syllabus:
High-frequency asymptotic techniques: Modal Solutions (MS), Geometrical Optics (GO), Physical Optics (PO), Geometrical Theory of Diffraction (GTD), Physical Theory of Diffraction (PTD), Radar Cross Section (RCS), Radiation and Scattering from Complex Structures.

I. Maxwell's Equations and Boundary Conditions

II. Review of the Wave Equation and its solution in:
   A. Rectangular coordinates
   B. Cylindrical coordinates
   C. Spherical coordinates

III. Radar Cross Section

IV. Radiation from Line Sources in an Unbounded Medium
   A. Electric
   B. Magnetic

V. Scattering from a perfectly electric conducting (PEC) circular cylinder
   A. Plane Wave
      1. Normal Incidence
      2. Oblique Incidence
   B. Line sources
      1. Electric
      2. Magnetic

VI. Scattering from a PEC Wedge
- A. Electric Line Source
- B. Magnetic Line Source

VII. Image Theory
- A. Line source above PEC strip

VIII. Physical Optics (PO)
- A. Physical Optics (PO) equivalent
- B. Scattering from a PEC:
  1. Strip
  2. Rectangular Plate
  3. Circular Plate
  4. Corner Reflectors
     - a. Dihedral

IX. Diffraction (Introduction)
- A. Knife Edge
- B. Strip
- C. Curved Surface Diffraction (creeping waves

X. Geometrical Theory of Diffraction (GTD)
Uniform Theory of Diffraction (UTD)
- A. Conducting Wedge: Normal Incidence
- B. Wedge Diffraction Coefficients
- C. Two-Dimensional Diffraction
- D. Three-Dimensional Diffraction
- E. Curved-Edge Diffraction
- F. Equivalent Currents in Diffraction
- G. Oblique Incidence
- H. Multiple Diffractions
- I. Two-Dimensional Wedge with Impedance Surfaces
  1. Maliuzhinets Functions
  2. Diffraction Coefficients
- J. Curved Surface Diffraction
  1. Creeping Waves
  2. Diffraction Coefficients
  3. Attenuation Coefficients
  4. Fock Functions
- K. Applications

XI. Physical Theory of Diffraction (PTD)
- A. PEC Wedge Diffraction
  1. Diffraction Coefficients

2. Fringe Currents
3. Equivalent Currents

B. Applications

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