EC3630

Radiowave propagation

TENTATIVE COURSE OUTLINE

I. Introduction

A. Overview

1. overview of propagation mechanisms: direct, earth reflected, refraction, troposcatter, ionospheric scatter, ground/surface waves, ionospheric reflections, meteor scatter, whistlers, terrain/obstacle diffraction, waveguide modes, non-atomospheric (water and ground)
2. system applications: radar, communications, EW, wireless
3. frequency bands: summary of propagation mechanisms by frequency band

B. Review

1. basic theorems and concepts: wave equation and solutions, boundary conditions, plane waves, spherical waves, lossy media, dispersion
2. polarization, anisotropic media
3. reflection and refraction
4. transmission lines and waveguides

II. High frequency propagation

A. Direct, reflected and refracted low altitude propagation

1. isotropic radiator
2. Friis equation, atmospheric losses, path gain factor
3. geometrical optics
4. Fresnel reflection from flat surfaces
5. total reflection (lateral wave?)
6. continuously stratified medium
7. mixed (arbitrary) polarization
8. equivalent earth radius
9. Fresnel zones
10. height gain curves
11. diffuse scattering from rough surfaces

B. Diffraction

1. Huygen's principle and diffraction
2. physical optics
3. geometrical theory of diffraction (GTD)
4. knife edge diffraction
5. curved earth and the bulge factor
6. path profile construction
7. software (EREPS)

C. Urban propagation

1. indoor/outdoor environment
2. analytical models (ray tracing)
3. empirical models (Hata, etc.)
4. software (Urbana, etc.)

III. Low frequency propagation

A. Ground waves

1. ground waves (Norton's model)
2. other types of surface waves (lateral, Zenneck, etc.)

B. Ionosphere

1. propagation in a magneto-ionic medium (Appleton-Hartree formula)
3. Faraday rotation
4. Chapman's theory and the ionosphere
5. secant law and maximum usable frequency
6. Breit and Tuve's theorem
7. Martyn's theorem
8. transmission path design

III. Miscellaneous topics

A. Anomalous and non-standard, and non-atmospheric propagation

1. ducting
2. meteor tails
3. propagation through the ground

B. Applications

1. satellite communications
2. HF OTH radar
3. ground penetrating radar