Electromagnetism and guided propagation

Component
École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

Semester
Printemps

In brief

- **Ametys Code:** N8AE03B
- **Open to exchange students:** No

Presentation

Objectives

Be able to physically analyze the interaction of a plane electromagnetic wave with an interface (dielectric or metallic)

Know the main properties of a plane wave

Understand what a mode in a waveguide refers to

Understand what the cutoff frequency of a mode refers to

Understand what dispersion refers to

Be able to calculate the power carried by a propagating mode in a waveguide

Description

I- Laws of classical electromagnetism

I-1- Concept of instantaneous electromagnetic fields

I-2- Maxwell's equations

I-3- Harmonic regime in electromagnetism

II- Electromagnetic propagation in free space

II-1- Electromagnetic field in free propagation

II-2- Group and phase velocities in free propagation

II-3- Application: interaction of a plane wave with a surface (metallic or dielectric)

III- Guided electromagnetic propagation

III-1- Electromagnetic field in guided propagation

III-2- Concept of propagating and evanescent modes

III-3- Dispersion phenomenon in electromagnetism

III-4- Group and phase velocities in guided propagation

III-5- Application: Calculation of the fundamental mode in a hollow rectangular metallic waveguide

Pre-requisites

Complex numbers - Differentiation and integration of functions of a real variable - Basic concepts of electricity and magnetism - Kirchhoff's laws (node law and loop law) and Ohm's law - Basic knowledge of analog electrical circuits.