

# Guided propagation



## Component

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

## In brief

- > **Ametys Code:** N7EE09A
- > **Open to exchange students:** Yes

## Presentation

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### Objectives

Know how to physically analyze the interaction of a plane electromagnetic wave with a dielectric interface.

- Know how to perform an electromagnetic power balance in free space.
- Know the main properties of a plane wave.
- Know what the Brewster angle refers to.
- Know what a mode in a waveguide refers to.
- Know what cutoff frequency means.
- Know what dispersion means.
- Know how to calculate the power carried by a propagative mode in a waveguide.
- Know how to calculate the energy stored by an evanescent mode in a waveguide.

- Know how to perform a power balance in guided electromagnetic propagation.

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## Description

I- Reminders: Laws of electromagnetism

I-1- Concept of instantaneous electromagnetic fields

I-2- Maxwell's equations

I-3- Harmonic regime in electromagnetism

I-4- Average power density and energy in electromagnetism

II- Electromagnetic propagation in free space

II-1- Modes in free space: concept of plane waves

II-2- Electromagnetic field of a plane wave and main properties

II-3- Law of conservation of electromagnetic energy in free propagation

II-4- Group and phase velocities of a plane wave

II-5- Example: Reflection and transmission coefficients of a plane

and static dielectric surface

III- Guided electromagnetic propagation

III-1- Guided propagation mode: concept of propagative and evanescent modes

III-2- Dispersion phenomenon in electromagnetism

III-3- Electromagnetic field of a mode and main properties

III-4- Law of conservation of electromagnetic energy in guided propagation

III-5- Group and phase velocities of a mode

III-6- Example: Rectangular guide with electric or magnetic walls

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## Pre-requisites

The content of the review (section I of this subject), namely (1) Maxwell's equations (classical laws of electromagnetism), (2) the constitutive equations of any medium, and (3) harmonic regime