

# Physical analysis of guiding structures



## Component

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

## In brief

- > **Amety's Code:** N8EE07E
- > **Open to exchange students:** Yes

## Presentation

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### Objectives

Know how to physically analyse the electromagnetic properties of guiding structures and cavities  
Know how to calculate the power carried and the energy stored in guiding structures excited by electromagnetic field sources  
Know how to establish and numerically solve the dispersion equation for any guided structures  
Know how to establish and numerically solve the resonance equation for any cavities

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### Description

- I- Modal representation of the electromagnetic field
  - I-1- Orthonormal modal basis in guided structures
  - I-2- Modal representation of the electromagnetic field
- II- Symbolic representation of closure and transition relations in electromagnetism
  - II-1- Symbolic representation of closure relations
    - II-1-1- Dipole for the representation of an infinite half-guide
    - II-1-2- Dipole for representing a short-circuited half-wave guide
    - II-1-3- Quadrupole for representing a section of guide
  - II-1-4- Application: maximisation of the power delivered by a harmonic current source

in a waveguide

II-2- Symbolic representation of the transition relations imposed on the electromagnetic field when crossing a surface

II-2-1- Virtual electromagnetic field sources and their dual quantities

II-2-2- Quadrupole for representing any surface

III- Formulation of boundary value problems without real electromagnetic field sources

III-1- Equivalent diagram of guiding structures without real sources

III-1- Formulation of boundary value problems based on Kirchhoff's and Ohm's laws

IV- Solving boundary value problems without real electromagnetic field sources

IV-1- Galerkin method with a virtual source test function

IV-2- Application No. 1: dispersion equation of a microstrip line

IV-3- Application No. 2: dispersion equation of a ribbed guide

V- Prospects in the field of electromagnetic modelling of guided structures

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## Pre-requisites

The subject 'Guided and free space propagation' (Apogée code N7EE09A1)