



## Faculty of Applied Sciences

### MECA2510 Dynamics of elastic systems.

[30h+30h exercises] 5 credits

This course is taught in the 2nd semester

**Teacher(s):** Jean-Pierre Coyette, David Johnson  
**Language:** French  
**Level:** Second cycle

#### Aims

Introduceh students to the specific techniques of mechanical vibrations, via simplified models.

Apply these techniques to important basic applications : suspensions, vibration isolation, measurement devices, vehicles, structures, #

#### Main themes

- Mathematical modelling of discrete and continuous systems, degrees of freedom, (non)linearity, stiffness, damping.
- Eigenvalue problems for discrete and continuous linear systems
- Forced response : frequency response functions, resonance, antiresonance.
- Specific investigation of vibration isolation and measurement devices.

#### Content and teaching methods

The mathematical models studied follow a gradually increasing complexification, both as regards number of degrees of freedom and physical terms involved. The course is subdivided into three main parts :

- Linear 1-degree-of-freedom systems : undamped free vibrations, harmonic oscillator, damped vibrations, forced vibrations, applications, vibration transmission to foundations, vibration isolation, measurement devices.
- Linear N-degree-of-freedom systems : undamped free vibrations, eigenvalue problem, normal modes of vibration, modal analysis, orthogonality, damped free vibrations, forced vibrations, anti-resonance, vibration absorbers, modal truncation, approximative methods in modal analysis (Rayleigh, Rayleigh-Ritz, #)
- Continuous systems : eigenvalue problem, boundary conditions, free vibrations of strings, shafts, beams, membranes, plates. Variational approach : approximative methods in modal analysis (Rayleigh, Rayleigh-Ritz, #).

#### Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Prerequisites :

Analytical mechanics, applied mathematics.

References :

Meirovitch Analytical Methods in Vibrations

Craig, R.R. Structural Dynamics

Dimaragonas Vibration for Engineers

Geradin, Rixen Vibration Theory

**Other credits in programs**

<b>ELME21/E</b>	Première année du programme conduisant au grade d'ingénieur (5 credits) civil électro-mécanicien (énergie)	Mandatory
<b>ELME21/M</b>	Première année du programme conduisant au grade d'ingénieur (5 credits) civil électro-mécanicien (mécatronique)	Mandatory
<b>ELME22/M</b>	Deuxième année du programme conduisant au grade (5 credits) d'ingénieur civil électro-mécanicien (mécatronique)	
<b>GC22</b>	Deuxième année du programme conduisant au grade (5 credits) d'ingénieur civil des constructions	Mandatory
<b>MECA21</b>	Première année du programme conduisant au grade d'ingénieur (5 credits) civil mécanicien	Mandatory