



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

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