

Vibration of Mechanical Systems

Vibration Analysis of Structures

IDENTIFICATION

CODE : GMCIP-5-S1-EC-AVS
ECTS : 2.0

HOURS

Lectures : 16.0 h
Seminars : 18.0 h
Laboratory : 0.0 h
Project : 0.0 h
Teacher-student
contact : 34.0 h
Personal work : 30.0 h
Total : 64.0 h

ASSESSMENT METHOD

2h exam and report

TEACHING AIDS

Lecture handout

TEACHING LANGUAGE

French

CONTACT

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AIMS

"This course comes under the teaching unit GMCIP-5-MECA, Mechanics and contributes to:
School science skills for the engineer:

- Analyze a system (real or virtual) or a problem (level 2)
- Implement an experimental approach (level 2)

School skills specific to the specialty:

- Use numerical simulation tools (level 2)
- Establish an experimental approach (level 2)
- Establish a problem solving approach (level 2)

By allowing the student to work and be assessed on the following knowledge:

- Equation of motion, modes shapes and natural frequencies, free response, forced response
- Damping, experimental modal analysis, finite element modeling.

By allowing the student to work and be evaluated on the following capacities:

- Calculate the eigen modes of an academic mechanical system in linear vibrations.
- Calculate the vibrational response of a system knowing the external dynamic loading applied to it or the initial conditions imposed.
- Set up a finite element model and analyze the results.
- Interpret and analyze numerical results and vibration measurements."

CONTENT

- "1. Equations of motion for simple structures (strings, beams in torsional, longitudinal or bending vibration)
2. Boundary conditions, modes shapes, property of orthogonality of the modes shapes
3. Free vibrations: initial conditions, modal decomposition
4. Forced vibrations: harmonic response, transfer function
5. Programming the response of a beam in bending vibration (MATLAB)
6. Finite Element Modeling (choice of elements, midsurface, convergence of model)
7. Analysis of experimental data, correlation between simulation and tests"

BIBLIOGRAPHY

- "M. LALANNE, J Der HAGOPIAN, Mechanical Vibrations for Engineers, John Wiley and sons, 1983
B. COMBES, Vibrations des structures pour l'ingénieur et le technicien: théorie et applications, Ellipses 2009
G. VENIZELOS, Vibrations des structures, Analyse modale, Modélisation, Ellipses 2012.
M. THOMAS, F. LAVILLE, Simulation des vibrations mécaniques par Matlab, Simulink et Ansys, 2007
J.L GUYADER, Vibrations in continuous media, Hermès Science/Lavoisier, 2002"

PRE-REQUISITE

GMCIP-4-VIB-S1, GMCIP-4-ANO-S1, GMCIP-4-MMEF-S1