INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

DPT GENIE MECANIQUE
INSA Campus LyonTech - DPT GENIE MECANIQUE - bât. J. FERRAND
12, des rue des sports - 69621 VILLEURBANNE
Phone 0472436226

Vibrations

Analysis of structural vibrations

IDENTIFICATION

CODE : GM-4-S2-EC-MEAVS
ECTS : 3.0

HOURS

Lectures :	20.0 h
Seminars :	24.0 h
Laboratory :	0.0 h
Project :	0.0 h
Teacher-student contact :	44.0 h
Personal work :	40.0 h
Total :	84.0 h

ASSESSMENT METHOD

Exam 2h

TEACHING AIDS

Lecture handout

TEACHING LANGUAGE

French

CONTACT

M. TOTARO Nicolas
nicolas.totaro@insa-lyon.fr
Phone : 0472438082

AIMS

*Analyzing a system (real or virtual) or a problem
Exploiting a model of a real or virtual system
Processing data
Implementing an experimental approach
Communicating an analysis, a scientific approach
Analyzing the expressed or assumed needs and define the design requirements of a mechanical system meeting these needs
Designing and pre-dimensioning a mechanical system
Using numerical simulation tools
Modeling the behavior of a multiphysics system or phenomenon
Setting an experimental approach
Setting a problem solving process

*Knowledge:
equation of motion,mode shape, natural frequency, free response, forced response, damping, experimental modal analysis, finite element mode.

* Capacities:
Being able to calculate the eigen-modes of a mechanical system in linear vibrations
Being able to calculate the vibratory response of a system knowing the external load applied to it
Being able to choose the method of discretization best adapted to the problem
Being able to set up the finite element model
Being able to interpret and analyze numerical results and vibratory measurements

CONTENT

1. Free vibrations of beams in torsion and / or compression traction (boundary conditions, initial conditions, modal scheme, modal decomposition, property of orthogonality of modes, ...)
2. Forced vibrations of beams in torsion and / or compression traction (force distribution, harmonic excitations, mass / spring equivalence)
3. Bending vibrations (boundary conditions, hyperbolic solutions) and vibrations of plates
4. Illustration of the modifications of structure by passive way to control the behavior (addition of mass, stiffness, etc ...) from the method of mobilities.
5. Programming of the response of a beam in flexion (MATLAB)
6. Finite Element Modeling (choice of elements, average surface area, convergence of the model) (ANSYS)

BIBLIOGRAPHY

M. LALANNE, J Der HAGOPIAN, Mechanical Vibrations for Engineers, John Wiley and sons, 1983ons, 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

GM-3-VIBAC-S2; GM-3-MEXP-S1; GM-3-MATH-S1; GM-4-MEMDS-S1