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INSTITUT NATIONAL DES SCIENCES APPLIQUÉES

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<u>-MEAVS</u>

ECTS :

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

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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

 Free vibrations of beams in torsion and / or compression traction (boundary conditions, initial conditions, modal scheme, modal decomposition, property of orthogonality of modes, ...)
 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

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