Module Description, available in: EN

Structural Vibrations

General Information

Number of ECTS Credits

3

Module code

TSM_StrVibr

Valid for academic year

2023-24

Last modification

2022-10-19

Coordinator of the module

Giacomo Bianchi (SUPSI, giacomo.bianchi@supsi.ch)

Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Lausanne			Lugano	Zurich		
Instruction				**X** E 100%			
Documentation				**X** E 100%			
Examination				**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

- Linear algebra (matrices, eigenvalues, eigenvectors,…), linear differential equations.
- Dynamic equilibrium of mechanical systems (mass, springs, dampers, natural frequencies,…)
- Fourier transform, Frequency Response Functions
- Entry-level experience with MATLAB/Simulink and NASTRAN NX

Brief course description of module objectives and content

Passive vibration control: dynamic isolation, impact alleviation and Tuned Mass Dampers. Dynamic response of elastomeric materials. Damping due to friction. Numerical modeling of damping in Finite Element packages. Techniques for experimental testing. Vibrations issues in high-performance machine tools.

Aims, content, methods

Learning objectives and acquired competencies

- Consolidate theoretical knowledge on structural vibrations
- Passive solutions for vibration alleviation: dynamic isolation, Impact alleviation, Tuned Mass Dampers
- Numerical modeling by lumped masses and Finite Elements (structural damping)
- Experimental Modal Analysis

Contents of module with emphasis on teaching content

- Brief theoretical review of mechanical oscillations
- Energy dissipation: viscous and hysteretic damping. Elastomeric material: information available on commercial catalogues and corresponding numerical models. Dissipation due to guideways friction
- Dynamic vibrations isolation and Tuned Mass Dampers: design guidelines and numerical modelling in Matlab/Simulink
- Damping modelling and dynamic analysis of systems with non-proportional, frequency-dependent damping (modelling in Matlab-Simulink and Siemens NASTRAN NX)
- Dynamic issues in Machine Tools. Dynamic response of a flexible structure interacting with a position-controlled loop. Mention of the interaction with the cutting process: forced response and stability

Teaching and learning methods

Frontal theoretical lessons with interaction. Self-developed numerical exercises in MATLAB/Simulink and Siemens Nastran NX.

Group projects under extensive teacher support, possibly with test bench design or experiments.

Literature

Lecture slides and lecture notes.

Assessment

Certification requirements

Module uses certification requirements

Certification requirements for final examinations (conditions for attestation)

The group exercise reports, the group project and the final exam contribute with the same weight to the final mark. Each of those scores alone must be sufficient.

Basic principle for exams

As a rule, all the standard final exams for modules and also all resit exams are to be in written form

Standard final exam for a module and written resit exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

calculator

Other permissible aids

none

Special case: Resit exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

calculator

Other permissible aids

none