Module Description, available in: EN

Structural and Vibration

General Information

Number of ECTS Credits

3

Module code

TSM_StrVibr

Valid for academic year

2020-21

Last modification

2019-10-21

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 a mechanical systems (mass, springs, dampers, natural frequencies,…)
- System Dynamic Analysis: stability and control
- Fourier transform.
- Entry-level experience with MATLAB/Simulink

Brief course description of module objectives and content

Structural vibrations: theoretical aspects, numerical modelling (Finite Element: reduced order models), experimental testing. Passive vibration control. Dynamic analysis of high performance machine tools.

Aims, content, methods

Learning objectives and competencies to be acquired

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

Module content with weighting of different components

- Theory review: systems with one degree of freedom (DOF).
- Energy dissipation: viscous and hysteretic damping
- Dynamic modelling in matlab/Simulink
- Dynamic vibrations isolation
- Tuned Mass Dampers
- Theory review: multi-DOF systems. Eigen-frequencies and mode shapes. Modal coordinates
- Dynamic analysis by Finite Element modelling. Model reduction techniques: Modal and Craig Bampton.
- Experimental Modal Analysis: tools and basic methodologies. Impact hammer, shakers, accelerometers
- Dynamic response of mechanical structures in controlled systems. The case of Machine Tools.
- Vibrations in rotating machinery.

Teaching and learning methods

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

Group project, possibly with test bench design.

Literature

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 standard final exams are conducted in written form. For resit exams, lecturers will communicate the exam format (written/oral) together with the exam schedule.

Standard final exam for a module and written resit exam

Kind of exam

Written exam

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

calculator

Other permissible aids

No other aids permitted

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

No aids permitted