Module Description, available in: EN

Structural Vibrations

General Information

Number of ECTS Credits

3

Module code

TSM_StrVibr

Valid for academic year

2026-27

Last modification

2023-09-10

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 specified for each location and module execution.
- Documentation is available in the language(s) listed for each location and module execution. If the documentation is in multiple languages, the percentage distributed is indicated (100% = all documentation provided).
- The examination, including both questions and answers, is provided entirely (100%) in the language(s) specified for each location and module execution. The exams are on-site.

	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,…)
- Fourier transform, Frequency Response Functions
- Experience with MATLAB/Simulink and NASTRAN NX

Brief course description of module objectives and content

Passive vibration control: dynamic isolation and Tuned Mass Dampers. Dynamic response of elastomeric materials. Damping due to friction. Numerical modeling of damping in Finite Element packages. Vibrations issues in 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 modeling by lumped masses and Finite Elements (structural damping)

Module content with weighting of different components

- 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

Teaching and learning methods

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

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

Literature

Lecture slides and lecture notes.

Assessment

Additional performance assessment during the semester

The module contains additional performance assessment(s) during the semester. The achieved mark of the additional performance assessment(s) applies to both the regular and the resit exam.

Description of additional performance assessment during the semester

Two guided exercises on dynamic suspensions and Tuned Mass Dampers, with matlab & simulink (15% of the final score).

Project work, with professor support (15% of the final score).

Executed in groups of 2-3 students.

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

list of main formulas, available on Moodle

Exception: In case of an electronic Moodle exam, adjustments to the permissible aids may occur. Lecturers will announce the final permissible aids prior to the exam session.

Special case: Resit exam as oral exam

Kind of exam

Oral exam

Duration of exam

30 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

calculator

Other permissible aids

list of main formulas, available on Moodle