

**Module Description, available in: EN**

## *Structural Vibrations*

**General Information****Number of ECTS Credits**

3

**Module code**

TSM\_StrVibr

**Valid for academic year**

2025-26

**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 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		
<b>Instruction</b>				X E 100%			
<b>Documentation</b>				X E 100%			
<b>Examination</b>				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