

CIVIL-468

**Dynamics of structures**

Beyer Katrin, Lignos Dimitrios

Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
<b>Hours</b>	<b>4 weekly</b>
Lecture	3 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

Dynamics loads on structures, equations of motion of linear single- and multiple-degree-of freedom systems; free and forced vibrations; damping in structures: modal superposition and response history analysis, earthquake effects

**Content**

Week 1: Course objectives, introduction of single degree of freedom (SDF) systems  
 Week 2: SDF systems, free vibration, response to harmonic, arbitrary and pulse excitations  
 Week 3: numerical evaluation/analysis of dynamic response  
 Week 4: Earthquake response of linear SDF systems  
 Week 5: Elastic response spectra  
 Week 6: Earthquake response of inelastic SDF systems  
 Week 7: Inelastic response spectra  
 Week 8: Multi-degree-of-freedom (MDF) systems  $n$  equations of motion  
 Week 9: Free vibration, Eigenvalue analysis  
 Week 10: Damping in structures, dynamic analysis and response of linear systems  
 Week 11: Earthquake analysis of linear systems, uncoupled modal response history analysis  
 Week 12: Vibration-based measurement techniques  
 Week 13: Earthquake response of conventional and base isolated structures  
 Week 14: Structural dynamics applications

**Keywords**

Structural dynamics, damping, response spectrum analysis, modal analysis

**Learning Prerequisites****Required courses**

Statique I, Statique II

**Recommended courses**

Analyse I, Algèbre linéaire, Physique générale I et II

**Learning Outcomes**

By the end of the course, the student must be able to:

- Develop insights into the working of structure dynamics from first principles
- Assess / Evaluate the dynamic response of structures under vibrations of various types

- Conduct response spectrum analysis
- Conduct numerical analyses of single and multi-degree of freedom systems
- Conduct hands on vibration-based analysis to infer the dynamic properties of structural systems

### Transversal skills

- Continue to work through difficulties or initial failure to find optimal solutions.
- Use a work methodology appropriate to the task.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Communicate effectively, being understood, including across different languages and cultures.

### Teaching methods

Powerpoint  
Tools to facilitate learning of structural dynamics  
in-class exercise sessions  
Assignments

### Expected student activities

Class participation, in-class exercise solutions, presentations

### Assessment methods

Semester assignments, final written examination

### Supervision

Office hours	Yes
Assistants	Yes
Forum	No
Others	The course lectures will be provided on line 2 days after each class

### Resources

#### Bibliography

Chopra, A.K., Dynamics of Structures - Prentice Hall, New Jersey

- Dynamique des structures / Paultre

â#¢Dynamics of structures / Chopra

#### Ressources en bibliothèque

- [Dynamics of Structures / Chopra](#)
- [Dynamique des structures / Paultre](#)

### Prerequisite for

Génie Parasismique. Dynamique des structures - méthodes numériques. Construction en béton. Construction métallique. Mécanique des sols et géotechnique. Construction en bois