CIVIL-369 **Structural stability**

Lignos Dimitrios

Cursus	Sem.	Type
Civil Engineering	BA6	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	3 weekly
Exercises	1 weekly
Number of positions	

Summary

Advanced topics in structural stability. Static and dynamic loads; elastic & inelastic buckling of columns; beam-columns; lateral-torsional buckling; nonlinear geometric effects; structural stability in the design codes; case studies include real-world applications of stability theory.

Content

- Week 1: Introduction and background
- Week 2: External work and principle of virtual work-principle of stationary total potential energy
- Week 3: Fundamentals of stability theory: Post-buckling behaviour, softerning
- Week 4: Euler and virtual work method
- Week 5: Snap-through buckling, elastic buckling of planar columns
- Week 6: Large deflection theory
- Week 7: Differential equations of planar flexure , pin-ended columns
- Week 8: Material nonlinearity, Inelastic column buckling, Stability of frames
- Week 9: Boundary conditions for bracing structures
- Week 10: Beam-column stability, behaviour of beam-columns, elastic limit interaction relationships
- Week 11: Lateral torsional and flexural buckling
- Week 12: Effect of boundary conditions on flexural and lateral torsional buckling
- Week 13: Applications of stability in steel design and design codes
- Week 14: Examples and failures from real-world applications

Keywords

structural stability, static & dynamic loading, flexural and lateral-torsional buckling, nonlinear behaviour, frame stability

Learning Prerequisites

Required courses

Statics, structural analysis, mechanics of materials

Recommended courses

Design of steel structures

Learning Outcomes

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

- Develop insights into the working of structural analysis and stability from first principles
- Assess / Evaluate the stability of structural components, frames under various types of loading
- Model nonlinear geometric effects in basic structural components and frame structures

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

2-hour lecture, 1-hour exercices
Use of:

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- Powerpoint
- Online lecture recording system to facilitate learning
- Tools to facilitate learning of stability theory
- in-class exercises

Expected student activities

Class participation, in-class exercise solutions

Assessment methods

1. Midterm written exam, 2. Final written exam

Supervision

Office hours	Yes
Assistants	Yes
Others	The course lectures will be provided online 3-hours after the end of each class.

Resources

Bibliography

- Ziemian, R.D. Guide to stability design criteria for metal structures (sixth edition)
- Bazant, Z., and Cedolin, L. Stability of structures
- Chen, WF., Lui, EM. Structural stability: Theory and Implementation
- Eurocodes

Ressources en bibliothèque

- Guide to stability design criteria for metal structures / Ziemian R.D.
- Stability of structures / Bazant Z., Cedolin, L.
- Eurocodes

Notes/Handbook

-The course lectures, list of in-class exercise problems and midterm/final exams are based on lecture notes that are provided weekly through Moodle.
-The course does not follow a specific Handbook.

Prerequisite for

Master projects in advanced steel design, nonlinear analysis, evaluation and testing of structural steel systems subjected to natural hazards, resilient-based steel design, Performance-Based Earthquake Engineering