Summary
Advanced topics in structural stability; elastic & inelastic column buckling; lateral-torsional buckling of bridge/plate girders; nonlinear geometric effects; frame stability; computational formulation of stability theory; Geometric stiffness method; Plate buckling; Plastic collapse analysis

Content
• Week 1: Introduction & easy statics
• Week 2: Plastic analysis and collapse loads
• Week 3: Stability of axially loaded members
• Week 4: Interaction curves - bending and axial load
• Week 5: Lateral torsional buckling of members - P1
• Week 6: Lateral torsional buckling of members - P2
• Week 7: Frame stability
• Week 8: Geometric stiffness method for buckling analysis
• Week 9: Euler method and equilibrium paths
• Week 10: Potential energy method for assessing stability
• Week 11: Dynamic method for assessing stability
• Week 12: Plate buckling
• Week 13: Applications of plate buckling in structural mechanics
• Week 14: Case studies on structural stability

Keywords
structural stability, static & dynamic loading, nonlinear geometric instabilities, nonlinear behaviour, frame stability, plastic analysis, plate buckling, plate girders

Learning Prerequisites
Required courses
• Statics
• structural analysis
• mechanics of materials and/or structural mechanics
Recommended courses
• Design of steel structures
• Design of concrete structures
• Statics
• Structural mechanics

Learning Outcomes
By the end of the course, the student must be able to:
• Assess / Evaluate
• Critique
• Design
• Estimate
• Analyze
• Check
• Dimension
• Define

Transversal skills
• Plan and carry out activities in a way which makes optimal use of available time and other resources.
• Set objectives and design an action plan to reach those objectives.
• Use a work methodology appropriate to the task.
• Communicate effectively with professionals from other disciplines.
• Access and evaluate appropriate sources of information.
• Use both general and domain specific IT resources and tools
• Communicate effectively, being understood, including across different languages and cultures.
• Identify the different roles that are involved in well-functioning teams and assume different roles, including leadership roles.

Teaching methods
3-hour lectures, 1-hour exercises
Use of:
• Power point
• Online reading
• Python-based tools to facilitate learning and computational thinking
• In-class exercises
• Problem sets

Expected student activities
• Class participation
• Weekly In-class exercises

Assessment methods
• Graded assignments (30% of the total grade)
• Final written exam (70% of the total grade)

Supervision

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

Resources

Bibliography
• Ziemian, RD. Guide to stability design criteria for metal structures
• Bazant, Z., and Cedolin, L. Stability of structures
• Chen, WF., Him, EM. Structural stability: Theory and Implementation
• SIA-263 / Eurocodes

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

Moodle Link
• https://go.epfl.ch/CIVIL-369

Prerequisite for
• Master projects in structural analysis and advanced design of structures
• Nonlinear static and dynamic analysis of structures
• Performance assessment of new and existing structures
• Performance-Based Earthquake Engineering (PBEE)