塑性力學

Theory of Plasticity

Course Information	
Course title	Theory of Plasticity
Semester	114-2
Designated for	COLLEGE OF ENGINEERING GRADUATE INSTITUTE OF CIVIL ENGINEERING, STRUCTURAL ENGINEERING DIVISION
Instructor	Li–Wei Liu
Curriculum Number	CIE7015
Curriculum Identity Number	521EM1160
Class	
Credits	3.0
Full/Half Yr.	Half
Required/ Elective	Elective
Time	Friday 2,3,4(9:10~12:10)
Remarks	The upper limit of the number of students: 34.
Course introduction video	
Table of Core Capabilities and Curriculum Planning	Table of Core Capabilities and Curriculum Planning
Course Syllabus	
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Course Description	This course starts from the inelastic behavior of materials and structures and basic concept of plasticity. Then it establishes analytical ways to understand the plasticity in different materials and structures. In addition, the recent progress in computational plasticity is introduced. Benefits of this course are for students to get familiar with experimental, analytical, and computational fundamentals in plasticity, to be familiar with the formulation of incremental analysis, and to have a basic understanding of the high-dimensional limit analysis. This knowledge is essential to meet the challenge posed by future engineering analyses and designs.
Course Objective	1. Understanding the inelastic behavior of materials and structures.

	2. Understanding the difference between theory of elasticity and theory of plasticity for materials & structures. 3. Remembering the constitutive theories of elastoplasticity. 4. Learning the incremental analysis (time series analysis) of elastoplastic models. 5. Experiencing the recent advances in computational approaches of elastoplastic solid. 6. Experiencing the limit analysis in high-dimensional load space of elastoplastic solid. 7. Activating self-learning for the related topics in theory of plasticity. 8. Experiencing the discussion with international students.
Course Requirement	1. Preview before the class 2. Discussion and exercise in the class 3. Review after the class
Student Workload (Expected weekly study hours before and/or after class)	9 to 12 hours
Office Hours	Appointment required.
Designated reading	1. Han-Chin Wu, Continuum Mechanics and Plasticity, Chapman & Hall/CRC, 2005. 2. Jirasek and Bazant, Inelastic Analysis of Structures, Wiley, 2002. 3. Chen and Han, Plasticity for Structural Engineers, Springer-Verlag, 1988.
References	1. Han-Chin Wu, Continuum Mechanics and Plasticity, Chapman & Hall/CRC, 2005. 2. Jirasek and Bazant, Inelastic Analysis of Structures, Wiley, 2002. 3. Chen and Han, Plasticity for Structural Engineers, Springer-Verlag, 1988. 4. Lubliner, Plasticity Theory, Macmillan, 1990. 5. Kaliszky, Plasticity Theory and Engineering Applications, Elsevier, Amsterdam, 1989. 6. Martin, Plasticity, MIT Press, Cambridge, Mass., 1975. 7. Brokowski, Analysis of Skeletal Structural Systems in the Elastic and Elastic-Plastic Range, Elsevier, 1988. 8. Nemat-Nasser, Plasticity, Cambridge University Press, 2004. 9. Baker and Heyman, Plastic Design of Frames 1 Fundamentals, Cambridge University Press, 1969. 10. Heyman, Plastic Design of Frames, Applications, Cambridge University Press, 1971. 11. Horne, Plastic Theory of Structures, 2nd ed., Pergamon Press, Oxford, 1979. 12. Mendelson, Plasticity: Theory and Application, Macmillan, 1968. 13. Hill, The Mathematical Theory of Plasticity, Oxford University Press, 1950. 14. Prager, An Introduction to Plasticity, Addison-Wesley, Reading, Mass., 1959.

	15 Kachanov, Foundations of the Theory of Plasticity, North-Holland, 1971. 16. Chakrabarty, Theory of Plasticity, 2nd ed., McGraw-Hill, 1998; 3rd ed., Butterworth-Heinemann, 2006. 17. Johnson and Mellor, Engineering Plasticity, Van Nostrand Reinhold, London, 1973. 18. Cristescu, Dynamic Plasticity, North-Holland, 1967; 2nd ed., World Scientific, 2007.

Grading

No.	Item	%	Explanations for the conditions
1.	Midterm exam	15%	
2.	Final exam	15%	
3.	Pre-class assignment	10%	
4.	In-class hand-in	10%	
5.	After-class hand-out	35%	
6.	Group project	15%	
7.	Personal project	0%	Bonus: 10 %

1. NTU has not set an upper limit on the percentage of A+ grades.
2. NTU uses a letter grade system for assessment. The grade percentage ranges and the single-subject grade conversion table in the NATIONAL TAIWAN UNIVERSITY Regulations Governing Academic Grading are for reference only. Instructors may adjust the percentage ranges according to the grade definitions. For more information, see the Assessment for Learning Section.

Adjustment methods for students

Teaching methods	
Assignment submission methods	Extension of the deadline for submitting assignments
Exam methods	
Others	Negotiated by both teachers and students

Progress

Week	Date	Topic
Week 1		Holiday: Peace memorial day

Week 2		Chapter 1: Beyond elasticity: Evidences of plastic behavior in multi-scale mechanics/Framework and relationship of solid mechanics
Week 3		Chapter 3: Models of perfect elastoplasticity: yield conditions and yield surfaces
Week 4		Chapter 3: Models of perfect elastoplasticity: plastic flow rules and the role of the equivalent plastic strain
Week 5		Chapter 3: Models of perfect elastoplasticity: the on-off switch of plasticity and the straining condition
Week 6		Holiday: Universal Children's Day
Week 7		Midterm exam
Week 8		Chapter 3: Models of perfect elastoplasticity: the two-phase dynamical system and tangent modulus and vibration analysis
Week 9		Chapter 4: Recent advances in computational plasticity.
Week 10		Holiday: Labor day
Week 11		Chapter 4: Recent advances in computational plasticity.
Week 12		Chapter 5: Models of hardening and softening elastoplasticity.
Week 13		Chapter 5: Models of hardening and softening elastoplasticity.
Week 14		Chapter 6: Piecewise linear multi yield surface models /Limit analysis: collapse surface.
Week 15		Chapter 7: Thermodynamic aspects of plasticity/ Generalized standard material models
Week 16		Final exam