

Advanced Geotechnical Engineering

4 units (selection)

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Target) The purpose of this lecture is to understand the method to analyze failure and deformation of soil structures.

Outline) First the fundamental equations governing deformation/failure of ground and their finite element formulations are given. Second the mechanical properties of soil and their elasto-plastic models are given. Finally the numerical methods of the finite element method incorporated with the elasto-plastic models are given to understand the deformation/failure of ground.

Style) Lecture

Keyword) *Porous media theory, elasto-plastic model, finite element method*

Fundamental Lecture) “[Methods for analysis of mathematical phenomena](#)”

(1.0), “[Advanced Soil Mechanics](#)”(1.0)

Relational Lecture) “[Methods for analysis of mathematical phenomena](#)”(0.5),

“[Advanced Soil Mechanics](#)”(0.5)

Requirement) Fundamental of differential/integral calculus and linear algebras are required.

Notice) Homework for 8 hours before and after the class for 4 hours is required.

Goal)

1. To understand the fundamental equations governing deformation/failure of ground and their finite element formulations
2. To understand the mechanical properties of soil and their elasto-plastic models
3. To understand the numerical methods of the finite element method incorporated with the elasto-plastic models

Schedule)

1. Introduction
2. Porous media theory
3. balance equations (1)
4. Balance equations (2)
5. Constitutive equations
6. Governing equations
7. Weak forms (1)
8. Weak forms (2)
9. Time integration

10. Newton-Raphson method

11. Newton-Raphson method (Exercise 1)

12. Newton-Raphson method (Exercise 2)

13. Linearization of weak forms (1)

14. Linearization of weak forms (2)

15. Finite element formulation (1)

16. Linearization of weak forms (2)

17. Numerical analysis (Exercise 1)

18. Numerical analysis (Exercise 2)

19. Elasto-plastic model (1)

20. Elasto-plastic model (2)

21. Fundamental mechanical property of soil

22. Elasto-plastic model of soil (1)

23. Elasto-plastic model of soil (2)

24. Elasto-plastic model of soil (3)

25. Two dimensional analysis (1)

26. Two dimensional analysis (2)

27. Two dimensional analysis (3)

28. Two dimensional analysis (4)

29. Numerical analysis (Exercise 1)

30. Numerical analysis (Exercise 2)

31. Numerical analysis (Exercise 3)

32. Numerical analysis (Exercise 4)

Evaluation Criteria) The Score is calculated by the efforts such as exercises and reports, and higher than 60 percent passes the grade.

Textbook) The text book is given in the class.

Reference) The text book is given in the class.

Webpage) <https://uls.is.tokushima-u.ac.jp/u-learning/index.php>

Contents) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216617>

Student) Students in other courses can take this lecture.

Contact)

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Hour: 学科の掲示を参照のこと)