*GC10010

Computational Structural Analysis

Credits 2 credits

Semester First semester (every even year)

Instructor TSUBAKI, Tatsuya

Contact Civil Eng. Building, 3F, Rm.308, Ext. 4043 tsubaki¥5443¥ynu.ac.jp

1. Objectives

To study the analysis method of structures taking into account the geometric nonlinearity and the material nonlinearity, and its application. It is the main target to understand the models of the nonlinear stress-strain relations for various materials subjected to short-time and long-time loading and the numerical solution methods for the structural problems with nonlinearity.

2. Topics

No.1 1. Tensor notation: 1) Indicial notation, 2) Various tensors
No.2 2. Deformation and strain: 1) Strain tensor, 2) Finite deformation
No.3 3) Strain rate
No.4 4) Example of finite deformation
No.5 3. Stress : 1) Stress tensor, 2) Equilibrium equation
No.6 3) Various stress tensors
No.7 4. Constitutive equations: 1) Assumptions of constitutive laws, 2) Elastic materials
No.8 3) Elastic-plastic materials, 4) Viscoelastic materials
No.9 5) Example of constitutive equation
No.10 5. Numerical methods: 1) Linear problems
No.11 2) Nonlinear material problems, 3) Geometrically nonlinear problems
No.12 4) Solution procedures
No.13 5) Example of discrete analysis method (1)
No.14 6) Example of discrete analysis method (2)

3. Textbooks / course materials

Textbook: Not specified. Handouts are given.
Reference books:
(1) The Finite Element Method, Vol.1,2 (O.C. Zienkiewicz and R.L. Taylor, McGraw-Hill)
(2) Constitutive Equations for Engineering Materials (Vol.1: Elasticity and Modeling, Vol.2: Plasticity and Modeling) (W.F. Chen and A.F. Saleeb, Elsevier, 1994)

4. Goals

(1) Acquiring ability to understand the advanced topics on structural mechanics: 1) finite deformation of structures, 2) constitutive relationships of various engineering materials, 3) numerical methods such as the finite element method
(2) Acquiring ability to solve problems encountered in the structural mechanics field: numerical solution techniques for 1) material nonlinear problems, 2) geometrical nonlinear problems

5. Methods

(1) Assignments are given to check the condition of acquiring the necessary knowledge of structural mechanics.
(2) Exercises are given to acquire the basic skills on numerical structural analysis.

6. Prerequisites and related courses

Students are supposed to have the fundamental knowledge on structural mechanics. It is also desirable to have the basic knowledge on programming languages.
More information: http://www.cvg.ynu.ac.jp/G5/tsubaki/lec_e.htm

7. Course requirement

The grade is determined based on the results of examinations (50%) and assignments (50%).