**GC10010**

**Computational Structural Analysis**

Credits 2 credits  
Semester First semester (every even year)  
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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:  

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%).