

## Solid Mechanics

2 units (selection)

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**Target**) The aim of this lecture is to master the fundamentals of the finite element method, which is important in designing the strength of machines and structures.

**Outline**) Finite element formulations for heat conduction and stress problems are described, and numerical methods used in the finite element analyses are also described.

**Style**) Lecture and exercise

**Keyword**) *elasticity, finite element method*

**Fundamental Lecture**) “**Mechanics**”(1.0), “**Numerical Analysis**”(1.0), “**Computational Mechanics**”(1.0)

**Relational Lecture**) “**Advanced Computational Science**”(0.5), “**Methods for analysis of mathematical phenomena**”(0.5)

**Goal**)

1. To understand a finite element formulation of a heat conduction problem
2. To understand a finite element formulation for stress analysis
3. To understand various numerical methods for finite element analyses

**Schedule**)

1. Brief introduction to the finite element method
2. Finite element analysis of 1-D heat conduction problem
3. Finite element analysis of 2-D heat conduction problem
4. Formulation of 3-D stress analysis
5. Finite element analysis of 3-D stress problem
6. Fundamentals of computer science
7. Method of Numerical Integration (Newton-Cotes Integration Method)
8. Method of Numerical Integration (Gauss Integration Method)
9. Solution of a system of linear equations (Direct method)
10. Fast direct solvers
11. Solution of a system of linear equations (Iterative method)
12. Fast iterative solvers
13. Solution methods for large-scale problems
14. Mesh generation algorithms
15. Mesh generation and visualization algorithms
16. Final Examination

**Evaluation Criteria**) Assignment (30%), Examination(70%)

**Reference**)

- ◇ Theory of Elasticity 3rd, S.P.Timoshenko and J.N.Goodier, McGraw-Hill, 1970.
- ◇ O.C.Zienkiewicz and K.Morgan, Finite Elements & Approximation, Dover, 2006

**Contents**) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216655>

**Student**) only corresponding students for the course

**Contact**)

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