Numerical Calculations

Syllabus Number 1A305
Special Subjects
Elective 2 credit
SHINOTAKE, Akihiko

1. Course Description

In this course students will acquire the basic techniques of simulating physical mechanical engineering phenomena using a computer. Students will also acquire techniques of modeling and solving numerically theoretical functions, which strictly cannot be solved numerically.

2. Course Objectives

The aim of this course is to acquire the basic ability to simulate actual mechanical engineering field conditions and fundamental phenomena using a computer.

3. Grading Policy

Evaluation is carried out by regular test (75%) and report on problem solving exercises (25%). It is requirement that you attend more than 2/3 of a unit acquisition. The submitted reports will be corrected and returned.

4. Textbook and Reference

Textbook
Makoto Mitsuda, Co-authored by Uchu Suda Numerical Calculation Method Morikita Shuppan Co. Ltd.
Reference
Zhao Hua'an Excel numerical calculation method Kyoritsu Shuppan Co.Ltd.

5. Requirements(Assignments)

It is important to have a thorough understanding in mathematics, especially calculus until 1st semester of 2nd year. Please prepare your textbook beforehand (about 1.5 hours) before class, please review the contents of the study carefully (about 1.5 hours), including using the textbooks and notes after the lesson. Please follow the examples. After the lesson, you will complete the exercises and submit the report according to the instructions given (about 2 - 3 hours). In the second (lecture) and the third (practical) contents of the lesson, examples of concrete preparatory and review contents are described.

6. Note

Please bring a scientific calculator. Depending on the degree of comprehension, the progress may be brief, so we will instruct the review subject and the next preparatory range at the time of each lesson. The contents of the print / assignment delivered in class will also be uploaded to LMS.

7. Schedule

[1] Explanation of the position, necessity etc. of numerical analysis in mechanical engineering
[2] Numerical solution of nonlinear equation (bisection method, Newton method) Lecture
[Preparation] Please read through p.1 - 8 of the first chapter of the textbook and clarify it such as marking a place which it can not understand and go to the class.
[Review] Understand the notes taken in class and organize them.
[3] Numerical solution of nonlinear equation (bisection method, Newton method) Practicum
[Preparation] While looking at the previous lesson note, considering an algorithm to solve the exercise problems 1.1 and 1.2, write it in the note and go to class.
[Practice] Practice the exercises 1.1 and 1.2 using PC software and programs in the CL classroom. (We will distribute supplementary prints at the time of class.)
[Review] To complete the exercise 1.1 and 1.2 exercised in the practical training and submit it as a report at the start of the next lesson.
[4] Numerical solution of simultaneous linear equations (Gauss sweep out method, convergence method) Lecture
[5] Numerical solution of simultaneous linear equations (Gauss sweep out method, convergence method) Practicum
[6] Function interpolation method and approximate expression Lecture
[7] Function interpolation method and approximate expression Practicum
[8] Numerical integration (trapezoid formula, Simpson's formula) Lecture
[9] Numerical integration (trapezoid formula, Simpson's formula) Practicum
[10] Numerical solution of ordinary differential equations (Euler method, Runge-Kutta method) Lecture
[11] Numerical solution of ordinary differential equations (Euler method, Runge-Kutta method) Practicum
[12] Numerical solution of partial differential equation, Lecture
[13] Numerical solution method of partial differential equation Practice 1 (parabola type)
[14] Numerical solution method of partial differential equation Practice 2 (hyperbolic type)
[15] Summary of general numerical calculation method, supplement