Basics of Computer Simulation

Syllabus Number 4E206
Special Subjects
Elective 2 credit

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1. Course Description

"Computer simulation" means to simulate behaviors or characteristics of actual systems by running computer programs. In the modern world with highly-developed economic, social, and production systems, computer simulation is indispensable for planning, analyzing, predicting or optimizing these systems.
In this course, students are required to use LMS and Scilab/Scicos, a free software for computer simulation and mathematical analysis.
Students are expected to acquire the knowledge and techniques related to DP2.

2. Course Objectives

Important contents to be learned in this course are:
1. Introduction to computer simulation, modeling principles
2. Introduction to Scilab/Scicos
3. Simulation of differential equations
4. Laplace transform and block diagrams for simulation
5. Probability distribution and stochastic systems
6. Simulation on Least Squares Method
7. Simulation of system optimization: linear/nonlinear programming
The first objective of the course is to learn and understand the basics of computer simulation and Scilab/Scicos.
The second objective is to develop mathematical models and block diagrams to simulate system behaviors with Scilab/Scicos.
The third objective is to simulate system optimization with Scilab or Microsoft Excel.

3. Grading Policy

Grading policy is based on the answer reports to assignments A and B (30%), and on final examination at the campus (70%). After report submission, the correct answers to the assignments are sent to the students qualified for final examination.

4. Textbook and Reference

Textbook
Hiroshi Hashimoto and Chiharu Ishii（橋本 洋志,石井 千春） Basics of Simulation with Scilab/Scicos, （SCilab/Scicosで学ぶシミュレーションの基礎） Ohm Publishing Co. , ISBN978-4-274-20487-6 (オーム社)
Reference
none

5. Requirements(Assignments)

It is necessary for students to install Scilab/Scicos in their PC. Windows OS is recommended.
This course uses LMS. Students are required to spend at least 30 hours for preparation study, review, and reports to assignments.

6. Note

The contents of the course are helpful in applying computer simulation to various fields such as engineering, natural science and social science.

7. Schedule

[1] Basics of computer simulation with mathematical models, Install of Scilab/Scicos
[2] Basic operation of Scilab/Scicos (1): chapter 2 of the textbook
[3] Basic operation of Scilab/Scicos (2): chapter 3 of the textbook
[4] Review of the basics of differentials and integrals
[5] Review of mathematics and mathematics in Scilab: matrices, probability distributions (section 4.1, 4.2 in the textbook)
[6] Laplace and inverse Laplace transform (section 4.3 in the textbook)
[7] Continuous-time and discrete-time model, transfer function, block diagram (section 4.4.1, 4.4.2 in the textbook)
[8] Model approximation based on least squares method (section 4.5.1, 4.5.2 in the textbook)
[9] Mathematical model in natural science -- diffusion model (section 5.1 in the textbook)
[10] Model of the spread of epidemic disease (section 5.2 in the textbook)
[11] Predators-victims model (section 5.3 in the textbook)
[12] Waiting queue (1) (section 6.5.1-6.5.3 in the textbook)
[13] Waiting queue (2) (section 6.5.4 in the textbook)
[14] Linear and nonlinear programming (1) (section 6.6 in the textbook)
[15] Linear and nonlinear programming (2)