Scientific Computing, Bridging Course, 5.0 hp

1TD045

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Department in charge of the course

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Division of Scientific Computing
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Teachers

- Igor Tominec, igor.tominec@it.uu.se, room ITC 2403

Course literature


[A] Andreas Hellander, Stochastic Simulation and Monte Carlo Methods, Uppsala University, Department of Information Technology, 2009

Course homepage

All course-related information is collected at http://studentportalen.uu.se

Course outline

The course consists of four modules. The theme of each module is indicated below:

<table>
<thead>
<tr>
<th>Module</th>
<th>Theme</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to Computer Arithmetic and Matlab</td>
</tr>
<tr>
<td>2</td>
<td>Systems of Linear Equations</td>
</tr>
<tr>
<td>3</td>
<td>Ordinary Differential Equations</td>
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<td>4</td>
<td>Monte Carlo Methods</td>
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Recommended reading

<table>
<thead>
<tr>
<th>Module</th>
<th>Pages in the course book [M]</th>
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<tbody>
<tr>
<td>1</td>
<td>xi–xii, 1–10 (not 1.2.5), 13 (first two paragraphs of 1.2.6), 16 (from 1.2.7)–28, 33 (from 1.4)–39</td>
</tr>
<tr>
<td>2</td>
<td>49–79 (not 2.4.8), 84 (from 2.5)–85 (not 2.5.1), 91–92</td>
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<tr>
<td>3</td>
<td>382–404 (not 9.3.5), 405–406, 413–414</td>
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<tr>
<td>4</td>
<td>This module is covered by Hellanders compendium</td>
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There are Exercises at the end of each chapter in the course book.

Training Activities

The course contains three types of training to support your learning: Lab Sessions, Workout Exercises, and Mini Projects.

Lab sessions

The course contains 6 sessions in the computer lab. Each session consists of a set of computer exercises. They have two objectives: (1) to introduce topics that will be covered in subsequent lectures, and (2) to introduce elements of Matlab programming. During the lab session, students will work individually or in pairs. There will be a teacher present to help out.

Workout exercises

In order to understand the course contents properly, it is necessary to exercise. Experience shows that it is useful to do a number of small exercises with pen and paper to get a good understanding of the details. For this reason, the students are presented with workout exercises to solve in each module. Students will work in pairs to solve these exercises, and they will get help from the teacher when they get stuck.

Mini projects

The exciting thing about scientific computing is to see how the computational algorithms are used to address applications where it is necessary to use computers in order to carry out the computations in reasonable time. The objective of the mini projects is to let the students experience this.

Before working on each mini project, the teacher will give a brief introduction. Then the students are expected to work on the project individually. Discussions among the students and with the teacher are encouraged.
Reports

The educational idea behind the various training activities in the course is that they will help students to better understand the course contents. An important aspect of this is that the activities will involve feedback from students to teachers and vice versa. For this reason it is mandatory for students to report their progress:

- Workout: written solutions should be shown to the teacher.
- Mini Project: written reports should be handed in to the teacher.

The teacher will inform you about the deadline for each report. It is required that these deadlines are met. *It is better to leave an incomplete report than to leave the report too late.* If you are unable to meet the deadline for special reasons, such as illness, then you should contact the teacher before the deadline.

Workload

The course gives 5 credit points. In the Swedish university system, credit points correspond to expected student workload. Roughly, the student is expected to work ca. 25–30 hours for each credit point. Consequently, you are expected to spend ca. 125–150 hours on the present course. The scheduled teaching sessions amount to ca. 40 hours. This leaves ca. 85–110 hours for your own course work outside the classroom.

Learning outcomes

At the end of the course, you should be able to:

- describe the key concepts covered in the course and perform tasks that require knowledge about these concepts;
- in general terms explain the ideas behind, and be able to use algorithms for solving linear systems, ordinary differential equations and for Monte Carlo simulations;
- analyze properties of the computational algorithms and mathematical models using the analytical tools presented in the course;
- discuss suitable methods and algorithms given an application problem;
- given a mathematical model, solve problems in science and engineering by structuring the problem, choose appropriate numerical method and generate solution using software and by writing programming code;
- present, explain, summarize, evaluate and discuss solution methods and results.
Grades and Examination

There are two grades for this course: Pass and Fail. The fundamental criterion for passing the course is to meet the goals stated above. In order to pass the course, you need to

1. solve all the mandatory workout problems correctly,
2. get all the mini project reports approval by the teacher,

Scholastic Dishonesty

Students may work together and discuss the homework problems with each other. Copying work done by others is an act of scholastic dishonesty and will be prosecuted to the full extent allowed by University policy. For more information on university policies regarding scholastic dishonesty, see the University of Uppsala’s policy at http://www.it.uu.se/edu/fusk.

Students with Disabilities

According to the University regulation all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you need help or want to get more information about it please contact the University of Uppsala’s services for students with disabilities.