Computeroriented Methods for Solving Differential- and Integralequations
WS 2001/02, University of Salzburg
Syllabus

1. Course Details

Lectures:	Every second Tuesday, 10-12 a.m. and 14-16 p.m., Room T05, (see detailed schedule)
Labs:	Every second Tuesday, 12-13 a.m. and 16-17 p.m., ComputerRoom, (see detailed schedule)
Instructor:	Roman Trobec, Room 1.08, `roman.trobec@ijs.si`
Course Materials:	`http://pluton.ijs.si/~roman/usalz/cmdie`
Office Hours:	During Labs

2. Textbooks

Main Text:

1. M.T.Heath: *Scientific Computing: An Introductory Survey*, *Second Edition,* McGraw Hill, New York 2001, (SC); Lecture notes accessible on*:*
   `http://www.cse.uiuc.edu/heath/scicomp/notes`

Supplementary Text:

1. W.H.Press at all.: *Numerical Recipes in C*, Cambridge University Press, On-Line version,
   `http://www.ulib.org/webRoot/Books/Numerical_Recipes/`

3. Course Overview and Objectives

This course attempts to provide a deeper understanding of the issues involved in designing and implementing computer programs intended to solved numerical problems. It is targeted at graduate students of all areas and advanced undergraduates interested in learning some of the fundamental mathematical techniques and algorithms used in scientific computing.
The course material follows Heath's textbook and covers: algorithms for solving linear systems of equations, optimisation and numerical solution of differential and integral equations.
We will be discussing recent papers on numerical methods, and students will perform a significant research project. After attending this course, students will be able to devise a numeric algorithm, to estimate its complexity and to implement it with an adequate computer program. They could also follow the forthcoming summer course (*High Performance Scientific Computing*) focused on designing and implementing parallel programs in the field of partial differential equations (PDE).

4. Prerequisites

This course is focused toward students who have some background form the area of computer science, programming languages, operating systems and mathematics. No specialised knowledge is expected from these fields. For example, the students should be familiar with variables, functions, pointers and basic control statements. If you feel uncertain about whether you have adequate preparation, please discuss this with the instructor.

5. Course Work

To pass this course, a student is expected to demonstrate knowledge and competence in the covered topics Grades will be based on homeworks, class projects and final exam. The overall grade will be determined as follows:
Solution of problems - homework: 30%
Class Project: 20%
Final Exam: 50%

Two hours of lectures (lecture notes are available on Class-web page) will be followed by one hour of student work. We are going to answer interesting review questions and solve some exercises from the textbook (review questions and exercises will be available on Class-web page).
Homework: Self initiative work is supposed here. The students can solve either the exercises from the textbooks or problems defined by themselves. It is expected that eleven homework assignments (one for each chapter) will be finished individually. The problem and results will be posted on the Class-web page to be shared among students as the material for the final exam.
Class Projects: Up to two students can work together on class projects, that has to involve an practical component—i.e. it is not simply a paper and pencil exercise, some working program code is expected. The projects will be selected from the textbook computer problems. We encourage you to come up with your own topic for your project. You will have two months to work on the project and to finish a written report including overview of the existing methods, stressing the advantage of the implemented method (possibly a new version) and commenting the obtained results. The project results will be posted on the Class-web page and presented in class if possible.
Final Exam: The final written exam will cover the complete course material including review questions from the text book and solved homework exercises. Students can use notes and books.

6. Schedule

Table below shows the tentative schedule for Computeroriented Methods for Solving Differential- and Integralequations WS 2001/02. There might be some variations.

No.	Date	Day	Topic	Reading	Homework/Project
1	Oct. 23	Tuesday a.m.	Introductory Overview	SC Chapter 1	
2	Oct. 23	Tuesday p.m.	Numerical Analysis	SC Chapter 1	Homework-1 Ch1
3	Nov. 13	Tuesday a.m.	Floating Point Operations	SC Chapter 1	
4	Nov. 13	Tuesday p.m.	System of Linear Equations	SC Chapter 2	Homework-2 Ch2
5	Nov. 27	Tuesday a.m.	System of Linear Equations	SC Chapter 2	
6	Nov. 27	Tuesday p.m.	Least Squares	SC Chapter 3	Homework-3 Ch3
7	Dec. 11	Tuesday a.m.	Least Squares	SC Chapter 3	
8	Dec. 11	Tuesday p.m.	Eigenvalue Problems	SC Chapter 4	Homework-4 Ch4
9	Dec. 18	Tuesday a.m.	Eigenvalue Problems	SC Chapter 4	
10	Dec. 18	Tuesday p.m.	Non-linear Equations	SC Chapter 5	Homework-5 Ch5
11	Jan. 15	Tuesday a.m.	Non-linear Equations	SC Chapter 5	
12	Jan. 15	Tuesday p.m.	Interpolation	SC Chapter 7	Homework-6 Ch7
13	Jan. 22	Tuesday a.m.	Numerical Differentiation	SC Chapter 8	
14	Jan. 22	Tuesday p.m.	Numerical Integration and Integralequations	SC Chapter 8	Homework-7 Ch8
15	Jan. 22	Tuesday p.m.	First term for CMDIE 01/02 exam	Project and Homeworks, due to exam	

Second term for CMDIE 01/02 exam : 13. March 2002
Third term for CMDIE 01/02 exam : 12. June 2002