HPSC - High **P**erformance **S**cientific **C**omputing
SS 2003, University of Salzburg

1. Course Details

Lectures:	In four blocks, during summer semester 2003, monthly on two consecutive days: Tuesday and Wednesday, 10-12 a.m. and 14-16 p.m, Room T05.
Labs:	After lectures, 12-13 a.m. and 16-17 p.m., Small Computer Room, (see detailed schedule).
Instructor:	Roman Trobec, Room 1.08, roman.trobec@ijs.si
Course Materials:	http://www-e6.ijs.si/~roman/usalz/hpsc03
Office Hours:	During Labs

2. Textbooks

Main Texts:

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
2. I.Foster: *Designing and Building Parallel Programs,* Addison-Wesley, 1996, (PP); Network version accessible on*:* http://swt.cs.tu-berlin.de/pa/dbpp

Supplementary Text:

1. V. Kumar, A. Grama, A. Gupta, and G. Karypis: *Introduction To Parallel Computing: Design And Analysis Of Algorithms,* Benjamin/Cummings, 1994, (PC).

2. L.J.Hennessy and D.A.Patterson*: Computer Architecture: A Quantitative Approach, 2nd Edition*. Morgan Kaufmann, 1996. (CA) *(NOTE: the second edition better covers this course.)*

3. Course Overview and Objectives

This course will cover some important issues form designing and implementing parallel programs particularly in the field of partial differential equations (PDE). Besides PDE, it covers also parallel architectures and design of parallel algorithms, with topics from communication and calculation complexity, and practical implementation of parallel programs within MPI environment. After attending this course, students will understand how parallel computers work and where are their strengths and weaknesses. They will be able to develop parallel algorithms and implement parallel programs.

4. Prerequisites

The study material is prepared as an autonomous course, but it can be seen also an upgrading of the course *Computeroriented Methods for Solving Differential- and Integralequations - CMDIE*. It 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. They should also be familiar with the basic methods for the solution of linear system, interpolation and numeric integration.

5. Course Work

Two hours of lectures (lecture notes are available on Class-web page) will be followed by one hour of labs. MPI library and MatLab program environment will be used for implementation of simple examples.

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 seven homework assignments 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 two class projects, that has to involve an practical component– i.e. it is not simply a paper and pencil exercise, some working parallel 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. Each project should be described by a written report including overview of the existing methods, commenting the obtained results, and listing possible further extensions. The project results will be posted on the Class-web page.

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.

5. Schedule

Table below shows the tentative schedule of HPSC in SS 2003. There might be some variations.

#	Date	Day	Topic	Reading	Homework/ Project
1	Mar. 18	Tuesday a.m.	Parallel Architectures	CA Ch.1-3	
2	Mar. 18	Tuesday p.m.	Design of Parallel Algorithms	PP Ch.2	HW-1
3	Mar. 19	Wednesday a.m.	Programming Tools	PP Ch.5,6,7	
4	Mar. 19	Wednesday p.m.	Communication & MPI	PP Ch.8	HW-2
5	Apr. 15	Tuesday a.m.	Ordinary Differential Equations	SC Ch.9	
6	Apr. 15	Tuesday p.m.	Case Studies 1	PP Ch.2	HW-3
7	Apr. 16	Wednesday a.m.	Initial Value Problem - IVP	SC Ch.9	
8	Apr. 16	Wednesday p.m.	Case Studies 2	PP Ch.2	HW-4
9	May 20	Tuesday a.m.	Boundary Value Problems	SC Ch.10	
10	May 20	Tuesday p.m.	Case Study-MD		HW-5
11	May 21	Wednesday a.m.	Iterative Solution - Linear System	SC Ch.11	
12	May 21	Wednesday p.m.	Iterative Solution - Linear System	SC Ch.11	HW-6
13	Jun. 17	Tuesday a.m.	Partial Differential Equations	SC Ch.11	
14	Jun. 17	Tuesday p.m.	Case Study-Heat Transfer		HW-7
15	Jun. 18	Wednesday a.m.	Partial Differential Equations	SC Ch.11	
16	Jun. 18	Wednesday p.m.	Exam terms: HPSC and CMDIE	Project and HW, due to exam	

6. Candidates

For those interested in, please send an e-mail on address: roman.trobec@ijs.si
or write your name and E-mail in the table below. Start of HPSC is foreseen for March 18. 2003 at 10 a.m.

No.	Name, E-mail
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