Course evaluation

Course:	DN2230, Fast numerical algorithms for large-scale problems, 7.5 credits
When conducted:	Fall 2010 (period 2)
Course leader and lecturer:	Mattias Sandberg
Scheduled teaching:	Lectures: 24h
Literature:	Numerical Linear Algebra, by Lloyd N. Trefethen and David Bau. Lecture Notes: Advanced Numerical Methods, by Michael Hanke
Course requirements:	Written examination (3 credits); Computer assignments (4.5 credits)
Number of registered students (students that have participated in some part of labs or written exam):	19
Performance percentage (Prestationsgrad):	86%
Examination percentage (Examinationsgrad):	84%

Course Goal

The goal is that the students shall be able to use the methods covered in the course, evaluate their results, and develop and implement extensions to a given problem starting from general principles. For this a thorough theoretical understanding of the concepts is needed.

This course emphazises the following ideas and concepts: Numerical linear algebra: eigenvalue algorithms, the power method and QR-iteration. Krylov space methods: conjugate gradients, GMRES, restarted GMRES, a glance at other Krylov space methods for linear equation systems. The multigrid method. Multipole methods.

Changes made from the 2009 to the 2010 version of the course

The first year the course was given, in 2009, it contained a part about wavelet methods. The material for this part was the book "Wavelets" by Bergh, Ekstedt, and Lindberg. Since this part of the course was a bit different from the others it was removed, in order for the course to become more homogeneous, concentrating on different aspects of numerical linear algebra.

Instead of the wavelet part, the 2010 edition of the course contained a section about eigenvalue calculation. The book "Numerical Linear Algebra"

by Trefethen, Bau was used for the this part of the course, as well as a complement to Michael Hanke's lecture notes for the part on Krylov space methods.

With the changes the content of the course is now less scattered; it is about different aspects of numerical linear algebra: fast matrix-vector multiplication (multi-pole), linear equation solving (Krylov space methods and multi-grid), and eigenvalue algorithms (Krylov space and other iterative methods, e.g. the QR-algorithm).

Examination

The format with compulsory home-work assignments and a final exam seems to have worked well. The students suggested that the home-work assignments should be emphasized more, so we decided that completion of the assignments within certain deadlines gives some bonus points for the final written exam. The performance on the exam then sets the grade for the course.

Literature

"Numerical Linear Algebra" by Trefethen, Bau, and "Lecture Notes: Advanced Numerical Methods", by Michael Hanke. The students expressed in the course questionnaire that both books were good, in particular "Numerical Linear Algebra". Hanke's lecture notes are a bit difficult to follow since they cover the material in great detail.

Student Course Questionnaire

15 students answered the course questionnaire.

1. Did you find the course easy or difficult?
   (a) 0% (0 st) Very easy.
   (b) 0% (0 st) Easy.
   (c) 60% (9 st) Medium.
   (d) 40% (6 st) Pretty difficult.
   (e) 0% (0 st) Very difficult.
2. In the beginning of the course, was it made clear what the goals of the course are?
   (a) 87% (13 st) Yes.
   (b) 13% (2 st) Neutral.
   (c) 0% (0 st) No.

3. Do you find the course interesting?

   (a) 33% (5 st) Yes, very.
   (b) 47% (7 st) Yes.
   (c) 20% (3 st) Neutral.
   (d) 0% (0 st) Not particularly.
   (e) 0% (0 st) No.

4. Do you feel that your prior knowledge before the course started was sufficient?

   (a) 53% (8 st) Yes.
   (b) 27% (4 st) Neutral.
   (c) 13% (2 st) No.

5. How did you like the book Numerical Linear Algebra?

   (a) 0% (0 st) Very good.
   (b) 93% (14 st) Good.
   (c) 7% (1 st) All right.
   (d) 0% (0 st) Not so good.
   (e) 0% (0 st) Bad.
   (f) 0% (0 st) I did not use it.

6. How did you like the lecture notes Advanced Numerical Methods?

   (a) 0% (0 st) Very good.
   (b) 47% (7 st) Good.
   (c) 33% (5 st) All right.
   (d) 7% (1 st) Not so good.
   (e) 0% (0 st) Bad.
   (f) 13% (2 st) I did not use it.

   Any comments you may have on the lecture notes:

   I find it hard to understand.

7. How many lectures did you attend?

   (a) 0% (0 st) Less than 20%.
   (b) 7% (1 st) 20-40%.
   (c) 13% (2 st) 40-60%.
   (d) 7% (1 st) 60-80%.

(e) 73% (11 st) More than 80%.

8. What is your impression of the lectures from a pedagogical perspective? (Is the material explained well? Does the lecturer speak and write clearly?)

   (a) 27% (4 st) Very good.
   (b) 60% (9 st) Good.
   (c) 13% (2 st) Acceptable.
   (d) 0% (0 st) Less good.
   (e) 0% (0 st) Bad.
   (f) 0% (0 st) Did not attend the lectures.

   Any comments you may have (constructive if possible):

   good writing; good explanations; friendly and relaxed, but productive atmosphere; good motivations for each chapter (google pagerank, particles,...)

9. How much time did you use for homework 1?

   (a) 40% (6 st) Less than 9h.
   (b) 27% (4 st) 9-14h.
   (c) 13% (2 st) 15-20h.
   (d) 20% (3 st) More than 20h.

10. How much time did you use for homework 2?

    (a) 27% (4 st) Less than 9h.
    (b) 33% (5 st) 9-14h.
    (c) 20% (3 st) 15-20h.
    (d) 7% (1 st) More than 20h.

11. How much time did you use for homework 3?

    (a) 60% (9 st) Less than 9h.
    (b) 0% (0 st) 9-14h.
    (c) 13% (2 st) 15-20h.
    (d) 13% (2 st) More than 20h.

12. Did you learn more from some homework(s) than the others?

    (a) 33% (5 st) Homework 1
    (b) 47% (7 st) Homework 2

(c) 33% (5 st) Homework 3

13. Do you think that the written exam measures well the content of the course?

    (a) 27% (4 st) Very well.
    (b) 40% (6 st) Well.
    (c) 13% (2 st) All right.
    (d) 0% (0 st) Less good.
    (e) 0% (0 st) Bad.
    (f) 20% (3 st) Did not take the exam.

14. How many other courses did you follow in study period 2?

    (a) 7% (1 st) Zero.
    (b) 33% (5 st) One.
    (c) 27% (4 st) Two.
    (d) 27% (4 st) Three.
    (e) 7% (1 st) Four or more than four.

15. What percentage of you total study time during period 2 did you spend on this course?

    (a) 7% (1 st) Less than 15%.
    (b) 20% (3 st) 15-30%.
    (c) 60% (9 st) 30-50%.
    (d) 13% (2 st) 50-70%.
    (e) 0% (0 st) More than 70%.

16. The course gives 7.5 course credits. Is this reasonable (compared to other courses)?

    (a) 0% (0 st) Shold be less than 7.5 credits.
    (b) 0% (0 st) Should be more than 7.5 credits.
    (c) 100% (15 st) 7.5 credits is ok.

17. Do you feel that you have been discriminated in this course because of gender, sexual orientation, ethnical origin, or any other cause?

    (a) 0% (0 st) Yes.
    (b) 93% (14 st) No.

18. Suggestions on improvements of the course:

    The course is of good standard however it's good if the course is made more easier.

    It might be better if the course becomes a bit practical than pure theoretical. e.g. it is not necessary to prove every theorem, instead MATLAB implementation could be used.

    Lectures were quite comprehensive but in my opinion they should be little bit more explaining especially multigrid concepts are tough to understand. The teacher is very cooperative and answers questions and queries well.

19. Any other comments about the course:

    great course! good organisation, motivating lectures, well structured, perfect homeworks (interesting and motivating, but not too hard to frustrate)

    Overall the course contents are enough for study period2 and the time assigned for the course. With other courses, it was still tough to manage with the course as the contents are not very easy. Anyhow, it was a nice experience.

Planned changes to the next time the course is given

A new homework with the multigrid method will be given. The first homework about the complexity of the QR algorithm will be changed such that the optimal complexity order can be obtained.