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MATH36032/MATH46032 - 2007/2008

General Information

- Title: Problem Solving by Computer
- Unit code: MATH36032/MATH46032
- Credits: 10 (MATH36032), 15 (MATH46032)
- Prerequisites: Basic knowledge of linear algebra, calculus (including partial derivatives) and differential equations, is assumed. Familiarity with MATLAB is helpful, though not strictly necessary. It will be assumed that students have a working knowledge of Windows, a Web browser, and a wordprocessing/typesetting package (for example, Microsoft Word, or LaTeX). Training will not be given in wordprocessing/typesetting.
- Co-requisite units: None
- School responsible: Mathematics
- Members of staff responsible: Dr. Françoise Tisseur

Maximum Class Size

The number of students who may take this course unit is restricted: the maximum class size is 40.

Specification

Aims

To develop skills in translating mathematical ideas into MATLAB programs, thereby using the computer as a tool to investigate and solve mathematical problems.

Brief Description of the unit

This module is concerned with using a modern computer software package for solving mathematical problems and hence it involves a reasonable amount of computer programming. The student will be given a thorough introduction to the capabilities of the state of the art software package MATLAB, covering numeric, symbolic (with the Symbolic Math Toolbox) and graphical features. Although MATLAB is the chosen course software, the emphasis will be given to principles that are not specific to any particular package. Basic principles of technical writing will also be taught, and the student will apply these to the written projects, which must be produced using a wordprocessing/typesetting package.

Learning Outcomes

On successful completion of the course unit students will be able to express the solution of a number of projects, using a combination of symbolic, numeric and graphical forms, in terms of robust and elegant programs employing the software package MATLAB. The projects, different each year, will be chosen from a variety of mathematical topics, including linear algebra, differential equations, multivariate calculus, mathematical finance, statistics, dynamical systems, and nonlinear equations, often linked to particular practical applications. Students will also have gained knowledge and experience of technical writing.

Future topics requiring this course unit

None.

Syllabus

1. **General Introduction:** Brief history of mathematical computing. Mathematical software packages, programming languages.
2. **Programming in MATLAB:** Essentials of MATLAB; vectors and matrices, colon notation, numeric output, graphics, control structures and logical tests. MATLAB functions. Symbolic and high precision computations.
3. **Projects:**Three projects will be set on mathematical topics, often with applications. No special background knowledge is required and the relevant theory will be covered in lectures. Marks will be awarded for mathematical content and correctness, use of MATLAB, and technical writing and presentation. For MATH46032 there will be an additional project.

4. **Laboratory Work:** Approximately half of the total of 36 contact hours will be spent on lectures and the remainder on supervised computer laboratory work on the projects. Students should expect to spend more than the allocated class-time on the computer to produce their projects.

Textbooks

Students are strongly advised to purchase [1]. In the introductory classes students will be required to work through the tutorial in Chapter one. Frequent reference will be made to this book in the lectures. For definitions of many of the mathematical terms in this course see [2]. For guidance on technical writing see [3].

- [1] Desmond J. Higham and Nicholas J. Higham, *MATLAB Guide*, Society for Industrial and Applied Mathematics, Philadelphia, PA, USA, 2000. ISBN 0-89871-469-9. xxii+283pp
- [2] David Nelson, editor,*The Penguin Dictionary of Mathematics*. Penguin, London, second edition, 1998. ISBN 0-14-051342-6. 461 pp.
- [3] Nicholas J. Higham. *Handbook of Writing for the Mathematical Science*. Society of Industrial and Applied Mathematics, Philadelphia, PA, USA, second edition, 1998. ISBN 0-89871-420-6. xvi+302 pp.

Teaching and learning methods

Three contact hours each week. In addition students should expect to spend at least four hours each week on private study for this course unit (seven hours for MATH46032).

Assessment

Projects (three for MATH36032 and four for MATH46032): 100%.

Arrangements