Workshop Report: Teaching Applications in Engineering, Maths and Physics using Matlab

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A workshop on Teaching Applications in Engineering, Maths & Physics using Matlab, organised jointly by the three relevant CTI Centres with the support of Cambridge Control Ltd, was held on 13 December 1999 at Queen Mary and Westfield College, London. The workshop consisted of four speakers and four hands on sessions, which gave the delegates an opportunity to use and try out some of the Matlab software outlined in the talks. The feedback from the day was positive and delegates gained an insight into the some of the possibilities of using Matlab as a teaching and learning tool.

MATLAB, Simulink and Stateflow - an Unsurpassed Basis for Engineering Modelling

Professor Gerry Cain, DSP & Communications manager at Cambridge Control Ltd, began by outlining how Matlab was conceived and has developed over the years to its current form. He described the main features and uses of the "core" Matlab package and then indicated how the functionality of Matlab can be greatly increased with the addition of over 40+ "bolt-on" packages. Gerry then went on to describe some of the new Matlab application packages which can be "bolted" onto the main Matlab engine, concentrating on the features and applicability of their Signal Processing Toolbox, Simulink3 and Stateflow. Gerry ended his talk by addressing some of the plans and ideas for future Matlab applications.

A Hierarchical Approach to Using MATLAB in Advanced Finite Element Analyses

Roger Crouch, a structural engineer at the University of Sheffield, explained that Matlab is used as a teaching and research tool throughout their four-year Engineering Mathematics undergraduate course and showed typical examples of what students encounter throughout his talk. In the first year, students gain an understanding of matrix algebra and some familiarity with FEA and using Matlab to solve simple FEA problems. In the second year students get to play with Matlab code in order to understand in more detail some of the Matlab features as well as gain more deeper understanding of FEA and how Matlab can help, such as iterative method routines. Third year students look at more complex matrix and FEA problems using Matlab and also look at how Matlab copes with errors. Students in their fourth year project work use Matlab, and Roger demonstrated an example of such work which showed a nuclear container vessel being hit by a plane at 500mph.

FELIPE – a finite element analysis (FEA) package

Martin Reed, Department of Biological Sciences, Brunel University, outlined the advantages and disadvantages of teaching finite element analysis using a computer-aided approach. Martin discussed that their approach, for their introductory level FEA course, is to use Matlab hand-in-hand with Fortran/C/Pascal to solve a particular FEA problem. He explained that each FEA problem is tackled on a stage-by-stage basis using different software routines with the output from each stage being as input data for the following stage. Martin stated that students gained experience in programming but also got a feel of what FEA is like on a stage-by-stage basis. The talk ended with a demonstration which showed how the stress on a tube is analysed using their software routines.

MATLAB in the Mathematics Classroom

Dr C Martin Crane of De Montfort University spoke about the use of Matlab in their first year mathematics algebra module and in their Numerical Linear Algebra and self-learning DSP MSc courses. He outlined the mathematics topics covered using Matlab and then went on to demonstrate the use and versatility of the Matlab programming language by showing some simple code and displaying the simulation. He went on to explain that by using Matlab, students get an idea of what an algorithm is by using simple matrix manipulations and by modifying the source code. Finally, he showed several examples of interactive simulations, including eigenvectors/eigenvalues, polynomial interpolations and the Newton Raphson method, which he uses in his lectures. He explained that these simulations, along with their source code, are available to students for them to explore in their own time, in order to gain a better understanding of that particular mathematics principle under study at the time.

Invitation from Dr Martin Reed

At the workshop, I demonstrated my finite element learning software package FELIPE, which ran under MS-DOS. I have now completed an improved version which runs under 32-bit Windows (Win95/98, WinNT). It is fully Windows-compatible, and self-standing. I have put an evaluation version, for free download, on my website www.brunel.ac.uk/~blstmbr/felipe

Could I please invite you to try it out and send your comments to me at Martin.Reed@brunel.ac.uk. The full version is available as described on the website.