

1 BEAR MATLAB Tutorial

1.1 Course Aims

The purpose of this course is to introduce the MATLAB programming environment for numerical computing and data analysis. The course is targeted towards PhD students, MPhil and MRes students and in general researchers at the university that want to improve their skills in MATLAB programming. Although there is no assumed knowledge for this course the pace is fairly brisk. The course is held over two days and split into four self contained sessions. Depending on the students skill/level of familiarity with MATLAB they choose to attend which ever session they may choose. The session are summarised in table (1). Those that may benefit from this course may be involved (but not limited to the following subject areas)

- Numerical simulation of Partial and Ordinary Differential Equations
- Signal processing and data analysis
- Machine Learning and artificial intelligence
- Control systems
- Numerical and scientific computing

Session	Description
Session 1	Introduction to MATLAB
Session 2	Numerical and Scientific Computing
Session 3	Signal processing and Data Analysis
Session 4	Review and Advanced Topics

Table 1: Session Summary

1.1.1 Session 1 Summary

Session 1 introduces the basics of MATLAB. We begin with a history of MATLAB and discuss related (free) alternatives. The session progresses by discussing the basic variables (scalars, vectors and matrices), their manipulation and plotting functions. Examples and exercise are worked through during the session. This session closes with a discussion on toolboxes and an introduction to SIMULINK.

1.1.2 Session 2 Summary

In session 2 we continue on by implementing some simple numerical algorithms. These are common algorithms required for numerical integration and the simulation of ordinary and partial differential equations. We do some exercise on numerical integration using Simpson's rule and numerical integration of ordinary differential equations using the Runge-Kutta methods. We end by considering numerical simulation of algebraic systems of partial differential equations giving some basic schemes. We recognise that the sessions are not long therefore we seek to point to relevant areas of literature for more complex schemes.

1.1.3 Session 3 Summary

The methods considered in session 3 are those that may be of interest to those in signal processing and data analysis. We introduce common concepts and conventions. Examples will include ideas from signal filtering, data interpolation, cluster analysis, principle component analysis (PCA) and basic kernel methods.

1.1.4 Session 4 Summary

This concluding session discusses the limitation and scope of matlab. We introduce C/C++ extensions for MATLAB and discuss strategies for parallel implementations. A question answer and review session s then provided.

References