Introduction to MATLAB

EL1150, Lecture 1 – Matlab Basics

Based on lectures by F. Gustafsson, Linköping University

What is Matlab?

- A software environment for interactive numerical computations

- Examples:
  - Matrix computations and linear algebra
  - Solving nonlinear equations
  - Numerical solution of differential equations
  - Mathematical optimization
  - Statistics and data analysis
  - Signal processing
  - Modelling of dynamical systems
  - Solving partial differential equations
 - Simulation of engineering systems

What will you learn in EL1150?

- Effective Matlab usage

  - Possibilities and limitations
  - Syntax and interactive computations
  - Matlab programming (using functions and script files)
  - Visualization
  - Optimization of code for efficient computations

Why should you attend EL1150?

- Matlab used (on a daily basis) in many engineering companies
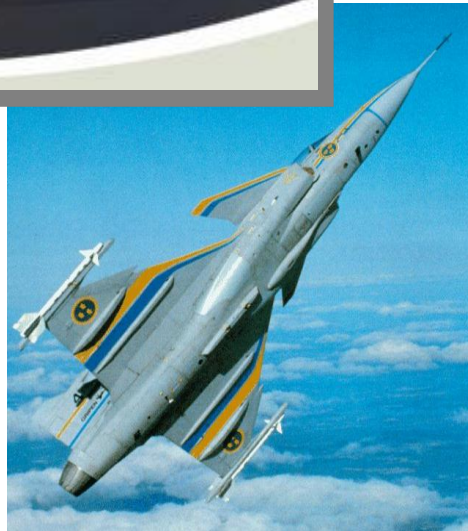
Why should you attend EL1150?

- Matlab used in many courses at KTH

Numerical analysis	Chemical Process Control
Signal and Systems I	Control Project Course
Signals and Systems II	Signal Theory
Modeling of Dynamical Systems	Digital Signal Processing
Automatic Control, Basic Course	Adaptive Signal Processing
Automatic Control, Advanced Course	Signal Processing Project
Nonlinear Control	Communication Theory
Hybrid and Embedded Control Systems	Advanced Communication Theory

and many, many more...

Today's Lecture

- Course information
  - Course contents and literature
  - Course guide

- Matlab Basics
  - Background to Matlab
  - Interactive calculations
  - Vectors and matrices
  - Graphical illustrations

- Next lecture: Matlab programming

Part I – Course Information

EL1150 – Introduction to Matlab

- Student Handbook:
  - One credit (1.5 ECTS) <u>self study</u> course.

- Objectives:
  - Gain basic knowledge of Matlab programming
  - To prepare for other courses where Matlab is used
  - To give insight into a state-of-the-art tool for technical computation and visualization

Course Literature

- N. Bergman and F. Gustafsson, *"Matlab for Engineers Explained"*, Springer, 2003
  - Available via student book store ("kårbokhandeln")
  - Teaches practical Matlab usage (not a full manual)
  - Basic description of theoretical concepts
  - Based on examples with guided tours of the system
  - Exercises with solutions
  - Applications from engineering courses
- Suggested exercises:
  - 1-5, 8-17, 21, 23-32, 34, 37, 40-41, 44, 47-48
- Alternative: Matlab help, exercise compendium on home page (free)

Course webpage

www.kth.se/ees/utbildning/kurshemsidor/control/EL1150

- Schedule
  - Computer Exercise #3
    Cancelled: Fri 4 March, 13 – 17
    New: Thu 10 March, 13 – 17

- Information

- Examination
  - Exam period
    Fri 11 March – Sun 27 March

Studies

- Self studies, guided tours

- Supervised computer sessions

- Questions via e-mail <pgpark@ee.kth.se>

- Examination in Bilda (bilda.kth.se)

More about the exam...

- Do the exam!
  - Most people that try the exam actually pass!
  - You have 72 hours
  - You can use all course material and the Matlab manuals!

- The exam: four problems drawn from the categories
  1. Basic matrix manipulations
  2. Operations on string variables (not covered in lectures)
  3. Writing functions
  4. Flow control
  5. Function functions

Part II – Matlab Basics

Matlab Background

- **Matlab** = **Mat**rix **Lab**oratory
- Originally a user interface for numerical linear algebra routines (Lapak/Linpak)
- Commercialized 1984 by The Mathworks
- Since then heavily extended (defacto-standard)

Alternatives		Complements	
Matrix-X		Maple	(symbolic)
Octave	(free; GNU)	Mathematica	(symbolic)
Lyme	(free; Palm)		

Construction

- Core functionality: compiled C-routines
- Most functionality is given as m-files, grouped into toolboxes
  - m-files contain source code, can be copied and altered
  - m-files are platform independent (PC, Unix/Linux, MAC)
- Simulation of dynamical systems is performed in Simulink
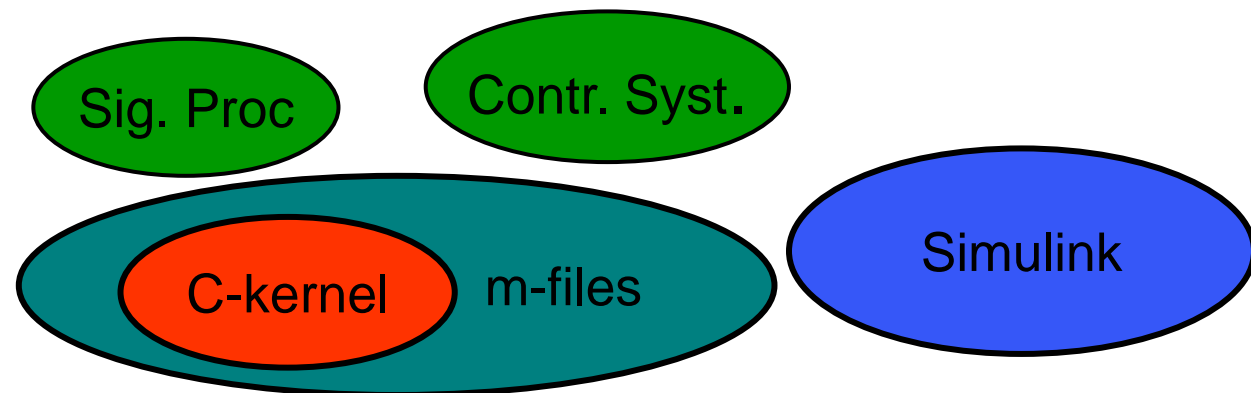
Matlab session

- Interactive calculations
- Variable and memory management
- The help system
- Vectors and matrices
- Matrix operators
- Matrix functions
- Indexing matrices
- Linear algebra
- Floating point numbers (limited precision)
- Graphics

Next lecture

- Matlab programming