

# MATLAB and computer simulations course for students FH Regensburg

7.2. – 11.2.2011

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## Monday

1. **Opening of course** 8:45 – 9:00
2. **MATLAB basics (Štekl)** 9:00 – 10:30

Environment basics – introduction, window environment, interpret style, Menu system  
Basic declarations – case sensitivity and basic working rules  
*Command Window, Workspace, History* – properties, working with windows  
Help Style, using help declarations with concrete commands

MATLAB programming language and basic commands (using in linear algebra, square matrixes, elementary functions and basic operations with vectors)  
Brackets (square, angle), parentheses. Semicolons and commas – meaning and usage.

Matrix principles in MATLAB language (declarations and using with examples)  
Matrix algebra (some functions), using “dot-operators” (like  $A \cdot B$  or  $A \cdot ' )$   
Selected helpful functions from help chapters *elmat* and *elfun* (like *atan*, *angle*, *pascal*, *magic*, *det*, *inv*, *diag*, *sort*, *sum*, *min*, *max*, *size*, etc.)  
Matrices with complex numbers (examples and functions)

System of linear equations – solving (using matrix operations – examples)  
Further functions – goniometrical functions, integral (*quad*), sorting.

3. **Basic graphical functions - graphs and figures (Štekl)** 11:00 – 12:30

M-files editor – basic functions (menu system, open, close, trace, name ...)  
Creating of basic MATLAB scripts (basic graphical output of a simple function, grid, *plot(x, y)*, *points*, *colours*, *axes*, *labels*, *title*, *scaling*, etc.)  
Functions with polynomial arguments (*polyfun*, *polyval*, etc.)  
Curve fitting – linear, polynomial and spline regression, graphical output (functions *polyfit* and *interp*) (**Štekl, Kropík**)

4. **MATLAB programming (Kropík)** 13:30 – 15:30

Flow control statements – loops (*for*, *while*), conditions (*if*, *switch-case*), etc.  
Editing m-files – creating functions (examples – cumulative integral and equation solving, user data input) (**Kropík**)  
**Possible training, questions, discussion (Štekl, Kropík)**

5. **Advanced functions and practising (Kropík)** 15:30 – 17:00

ODE-functions – solving of first order ordinary differential equations, system of differential equations, higher orders differential equations. (**Kropík**)  
Interactive input / output commands, user defined error messages, commentary (functions *input*, *error*, *msgbox*) (**Kropík**)

## Tuesday

1. **ODE functions application (Kropík)** 8:30 – 10:00  
Examples of simple transient phenomena – RC, RLC circuit etc.
2. **ODE functions application – continue (Kropík, Štekl)** 10:30 – 12:30  
Solving problems using ODE solver, creating own application.

3. **Introduction to 3D graphs (Štekl)** 13:30 – 15:00  
 (meshgrid, mesh, surf, surf1, colormap, shading, interp).  
 Examples of 3D functions (functions depended on two variables).  
 3D curve – Line Plots of 3-D Data (plot3), examples – integral of 3D curve. Using  
 3D style on the complex grid and complex graphs.

4. **MATLAB – graphics, GUI and multimedia (Kropík, Štekl)** 15:30 – 17:00  
 Advanced settings of graphical outputs and graphical user interface (automated  
 adjustment of figure size in depend on screen size etc.)

Graphical user interface – drawing layout, development, basic skills, predefined dialog  
 boxes, development of a simple graphical user interface application.

**Practicing, standalone working on examples with help of lecturers. (Kropík, Štekl)**  
 Creating animated sequences (movies and animated graphics), audio-video functions  
 (loading of audio data, creating audio files etc.) – for advanced users.

### Wednesday

1. **Fourier transformations – FFT** (example, harmonic signal analysis – noised input  
 signal, construction of dynamic FFT system in other programs - **Štekl**)  
 8:30 – 09:00
  2. **Autonomous working and brush-up** on more extensive example, working with  
 complex numbers, applying ODE functions, dialog boxes, graphical interface,  
 animations (with help of lecturers - **Kropík, Štekl**) 9:00 – 10:00
  3. **MATLAB test - Kropík, Štekl** 10:30 – 11:30
  4. **Results of MATLAB test** 13:30 – 14:00
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5. Matrix analysis of networks ( 1. and 2. incident matrix, methods of loop currents,  
 nodal voltages) (**Benešová**) 14:00 – 15:00
  6. MATLAB instruction for steady-state analysis (**Kotlan**) 15:00 – 17:00  
 DC and AC nodal analysis, DC and AC loop analysis, incidence matrix, resonance

### Thursday

1. Matrix equation for transients analysis – theory (**Benešová**) 8:30 – 9:00
2. MATLAB instruction for transients analysis (**Pánek, Kotlan**) 9:00 – 10:30
3. Frequency-domain analysis, transfer functions (examples in MATLAB)  
 (**Pánek, Kotlan**) 11:00 – 12:30
4. Practising – MATLAB files for steady-state and transient analysis – examples  
 (**Pánek, Kotlan**) 13:30 – 15:00
5. **Introduction to LTspice (Pánek)** 15:30 – 17:00  
 Preparing problems for simulation , creating **LTspice** models –  
 working with standard blocks, setting up simulation preferences  
 Analyzing simulation results

### Friday

1. Tutorial - MATLAB files for steady-state and transient analysis  
 creating **LTspice** models (**Pánek, Kotlan**) 8:30 – 9:00
2. Independent practise + examination 9:30 – 11:00  
 (**Pánek, Kotlan, Benešová**)
3. Evaluation, closing summary 13:30 – 14:00

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