

MATLAB and computer simulations course for students OTH Regensburg

10.2. – 14.2.2020

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Monday

- 1. Opening of course** 8:30 – 8:45
- 2. MATLAB basics (Juřík, Kropík)** 8:45 – 10:15
Environment basics – introduction, window environment, interpret style, menu system
Basic declarations – case sensitivity and basic working rules
Using help and doc declarations with desired commands

MATLAB programming language and basic commands (use in linear algebra, square matrices, elementary functions and basic operations with vectors)
Meaning and usage of brackets, braces and parentheses + semicolons and commas.

Matrix principles in MATLAB language (declarations and using with examples)
Matrix algebra (some functions), using “dot-operators” (like A.*B or A.‘)
Selected basic helpful functions (size, length, min, max, abs, sum, rand, zeros, ones, eye, pascal, magic, det, inv, diag, etc.)
Matrices with complex numbers (examples and functions)
- 3. Basic graphical functions - graphs and figures (Juřík, Kropík)** 10:30 – 12:00
M-files editor – basic scripts and functions
Basic graphical output of a simple function - plot, grid, styling, axes, labels, title, legend, xlim, ylim, etc.
Curve fitting – linear, polynomial and spline regression, graphical output (functions polyfit, interp and spline)
Functions with polynomial arguments (polyval, etc.)
- 4. MATLAB programming (Kropík, Juřík)** 13:00 – 14:30
Flow control statements – loops (for, while), conditions (if, switch-case)
Solving the integrals (integral, trapz, int, etc.)
System of linear equations
Possible training, questions, discussion
- 5. Advanced functions and practicing (Kropík, Juřík)** 14:45 – 16:15
Interactive input / output (input, fprintf, etc.) commands, user defined error messages (error, warning, msgbox).
Possible training, questions, discussion

Tuesday

- 1. ODE functions application (Kropík)** 8:30 – 10:00
Examples of simple transient phenomena – RC, RLC circuit etc.
Solving the first order ordinary differential equations.
- 2. ODE functions application – continue (Kropík)** 10:15 – 12:00
Solving problems using ODE solver. Showing the difference between solvers (ode45, ode23, ode115, etc.).
System of differential equations, higher orders differential equations.

3. **Introduction to 3D graphs (Juřík)** 13:00 – 14:30
 Examples of 3D functions (functions dependent on two variables).
 3D curve – Line Plots of 3-D Data (`plot3`). Using 3D style on the complex grid and complex graphs (`meshgrid`, `mesh`, `surf`, `colormap`, `shading`, etc.).
 4. **MATLAB – graphics, GUI and multimedia (Juřík)** 14:45 – 16:15
 Graphical user interface – drawing layout, predefined dialog boxes, App Designer.
 Multimedia – Creating animated sequences (movies and animated graphics). Simple image processing.
- Practicing, standalone working on examples with help of lecturers*

Wednesday

1. **Advanced user-defined functions (Juřík)** 8:30 – 09:15
 Variable number of arguments, name-value arguments, anonymous functions, nested functions, function header options.
2. **Standalone working (Kropík)** 9:15 – 10:00
 .. on more extensive examples, working with complex numbers, applying ODE functions, dialog boxes, graphical interface
3. **MATLAB test (Kropík, Juřík)** 10:30 – 11:30
4. Matrix analysis of networks (1. and 2. incident matrix, methods of loop currents, nodal voltages) **(Benešová)** 13:30 – 14:45
5. **Results of MATLAB test** 14:45 – 15:00
6. MATLAB instruction for steady-state analysis. **(Pánek)** 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 – 9:15
2. MATLAB instruction for transients analysis **(Pánek, Slobodník)** 9:15 – 10:45
3. Frequency-domain analysis, transfer functions (examples in MATLAB) **(Pánek, Slobodník)** 11:00 – 12:30
4. Practicing – MATLAB files for steady-state and transient analysis – examples **(Pánek, Slobodník)** 13:30 – 15:00
5. **Introduction to LTspice (Slobodník)** 15:20 – 16:50
 Preparing problems for simulation, creating *LTspice* models – working with standard blocks, setting up simulation preferences.
 Analyzing the simulation results.

Friday

1. Discussion 8:00 – 8:30
2. Standalone work + examination **(Pánek, Slobodník, Benešová)** 8:30 – 10:45
3. Evaluation, closing summary 13:30 – 14:00