

# Introduction to Programming Matlab for Engineers

Tutor: Sáfár Orsolya (safaro@math.bme.hu)  
Course code: BMETE90AX50  
No. of credits: 3  
Classes: Fridays 10-12

**Short description:** The goal of the course is to present a versatile and effective tool (for numeric and symbolic calculations, simulations, creating graphics and presentations), the Matlab software, which the students can also use later as researchers.

**Prerequisites:** Introductory single-variable calculus and basic linear algebra (a one semester university course of each is sufficient).

## **Detailed course description:**

Introduction: Matlab as numerical calculator. Defining vectors, built-in vector operators. Matrix operations. Logical indexing of arrays.

Defining custom functions, using the built-in debugger of the Matlab editor. Cycles and logical operators in Matlab, implementing simple algorithms.

Symbolic calculations: calculating limits, derivatives, integrals.

The consequences of using floating point arithmetic: inaccurate number representation, the propagation of error during calculations.

Solving systems of linear equations using Matlab, exploiting the properties of the coefficient matrix (triangular, symmetric hermitian, sparse). Estimating the precision of the solution using the condition number. Solving under and over determined systems.

Interpolation using polynomials, parameter fitting, log-log scale. Solving nonlinear equations.

Importing data: file handling, importing and exporting text files, modifying and processing texts. Importing and handling Excel files, creating basic statistics. Importing, storing and modifying pictures. Processing pictures: contour detection and counting objects.

Graphics in Matlab: creating and exporting plots, diagrams and histograms.

Basic statistics in Matlab, applying statistical tests for independence and fitting. Problem of generating random numbers.

Usage of the publish function, creating presentations and documentation.

Solving differential equations and stiff systems of equations. The types of equilibria, stability testing.

**Course requirements:** Final mark is based on homework assignments and two midterm tests. The two midterm tests are each worth a maximum of 50 points. Students need to reach 20 points for each midterm test to pass. Students can retake each midterm test to improve their final mark. Passing the two midterm tests and attendance at least at 70% of the contact lessons is required as a condition for obtaining the credits for the subject. A total of 15 points can be obtained from the homework assigned each week. Maximal final score is  $50+50+15=115$ . Marks based on the total score are as follows:

0-39:	1
40-54:	2
55-69:	3
70-84:	4
85+ :	5