



## Course Title:

### **MATLAB Data Analytics**

## Course Purpose:

This three-day course provides hands-on experience with performing data analysis with MATLAB. Examples and exercises demonstrate the use of appropriate MATLAB, Statistics Toolbox, Optimization and Global Optimization Toolbox functionality throughout the analysis process, starting from importing and organizing data, to exploratory analysis, to confirmatory analysis, defining and solving optimization problems and applying the results. Topics include:

- Managing data
- Visualizing data
- Fitting distributions
- Performing tests of significance
- Fitting regression models
- Generating random numbers and performing simulations
- Specifying objective functions & constraints
- Running optimization problems in MATLAB
- Evaluating results and improving performance
- Using global optimization methods

## Pre- requisites

MATLAB Fundamentals course or equivalent knowledge. Knowledge of linear algebra and knowledge of basic statistics.



- ✓ 3 training days
- ✓ Hours: 09:00-17:00
- ✓ Total training hours: 24

## Teaching method

The course combines lectures, demonstrations and practical exercises in MATLAB, using original training books from MathWorks. The course is in Hebrew but the training materials are in English.

עמוד מס' 1

### **Training Center Systematics - Contact information:**

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**Website:** <http://www.systematics.co.il/mathworks>



## Course Objective:

### Importing and Organizing Data

**Objective:** Understand the import methods and data types available in MATLAB and Statistics Toolbox to bring data into MATLAB and organize it for analysis. Perform common tasks, such as merging data and dealing with missing data.

- Importing data
- Data types
- Merging data
- Categorical data
- Missing data

### Exploring Data

**Objective:** Perform basic statistical investigation of a data set, including visualization and calculation of summary statistics.

- Plotting
- Central tendency
- Spread
- Shape
- Correlations
- Grouped data

### Distributions

**Objective:** Use the functionality in Statistics Toolbox to investigate different probability distributions and to fit distributions to a data set.

- Probability distributions
- Distribution parameters
- Comparing and fitting distributions
- Nonparametric fitting
- Distribution objects

### Regression

**Objective:** Perform predictive modeling by fitting linear and nonlinear models to a data set. Explore techniques for improving model quality.

- Linear regression models
- Fitting linear models to data
- Evaluating the fit

עמוד מס' 2

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### Random Numbers and Simulation

**Objective:** Use random numbers to evaluate the uncertainty or sensitivity of a model, or perform simulations. Generate random numbers from various distributions, and manage the MATLAB random number generation algorithms.

- Generating numbers from standard distributions
- Generating numbers from arbitrary distributions
- Controlling the random number stream

### Running an Optimization

**Objective:** Understand the basic structure and process of solving optimization problems effectively. Use interactive tools to define and solve optimization problems.

- Identifying the problem components
- Running an optimization using the Optimization app
- Applying the optimization process
- Using optimization functions

### Specifying the Objective Function

**Objective:** Implement an objective function as a function file. Use function handles to specify objective functions and extra data.

- Using an objective function file
- Specifying objective functions with function handles
- Passing extra data to objective functions

### Specifying Constraints

**Objective:** Add different kinds of constraints to an optimization problem in MATLAB.

- Identifying different types of constraints
- Defining bounds
- Defining linear constraints
- Defining nonlinear constraints

### Choosing a Solver

**Objective:** Select an appropriate solver and algorithm by considering the type of optimization problem to be solved.

- Classifying the objective
- Choosing a solver

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- Choosing the algorithm

### Evaluating Results and Improving Performance

**Objective:** Interpret the output from the solver and diagnose the progress of an optimization. Increase accuracy and efficiency of an optimization by changing settings.

- Examining the optimization
- Interpreting the result

### Using Global Optimization Methods

**Objective:** Use Global Optimization Toolbox functionality to solve problems where classical algorithms fail or work inefficiently.

- Finding the global minimum Using different algorithms

עמוד מס' 4

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