

Catch-Up courses for BRUFACE students

2019-2020



# MATLAB – Basics & Statistics

Taught by Thomas van den Dries (tvddries@etrovub.be)

MATLAB is a software package that provides tools to numerically analyze and solve problems. It will be commonly used in multiple courses for making projects, analyzing and plotting data, and more.

## Lecture 1: MATLAB for dummies (3h)

Wed 18 Sep 2019 – 13:00-16:00 – K.1.PC5

An intuitive, practically oriented MATLAB tutorial for non-experienced users without preliminary knowledge. From MATLAB matrix manipulation to graphically displaying data.

## Lecture 2: MATLAB for beginners (3h)

Tue 24 Sep 2019 – 14:00-17:00 – K.3.125(PC4)

As a continuation on the previous section, the focus is on the basics of programming: scripts and functions, control loops, conditions, (formatting) input/output, designing nice automated plots, etc.

## Lecture 3: Statistics for dummies (3h)

Wed 25 Sep 2019 – 13:00-16:00 – K.3.125(PC4)

An intuitive practically oriented tutorial on statistics for non-experienced users using MATLAB examples. Basic notions:

* Mean/expected value
* Variance
* Correlations
* Distributions
* Histograms
* PDF, PMF, CDF, etc.

## Lecture 4: Statistics for beginners (3h)

Wed 2 oct 2019 – 9:00-12:00 – K.3.110(PC3)

As a continuation on the previous section, more advanced (multidimensional) distributions will be discussed.

* Covariance
* Confidence intervals
* Estimators and its properties
* Illustration and examples in MATLAB.

# MATLAB – Signals & Systems

Taught by Ivan Markovski (Ivan.Markovsky@vub.be)

## Lecture 1 (2h)

Mon 30 Sep 2019 – 13:00-15:00 – K.3.110(PC3)

* Theory
  + Definition of signals and systems
  + Categories of systems (static/dynamic, linear/nonlinear, time-varying/time-invariant, continuous/discrete), Linear Time-Invariant (LTI) continuous systems, Laplace Transform
  + Transfer Functions (order, poles, zeros, gains)
  + Types of excitation signals.
* MATLAB
  + Construction of transfer functions
  + Computation of poles and zeros
  + Computation of the system response to a step, a random and/or an impulse excitation

## Lecture 2 (2h)

Mon 7 Oct 2019 – 13:00-15:00 – K.3.110(PC3)

* Theory
  + Response of a LTI system to a sinusoidal input
  + Frequency Response Function (FRF) and Bode plots (Amplitude and Phase)
  + FRF of first and second order systems
  + Bode plots of commonly used transfer functions
  + Detection of poles and zeros in the Bode plot
* MATLAB
  + Computation of the Bode plot
  + Computation of the system response to a sinusoidal excitation
  + Removal of transient effects

## Lecture 3 (2h)

Mon 21 Oct 2019 – 13:00-15:00 – K.3.110(PC3)

* Theory
  + Frequency content of a signal
  + Continuous Fourier Transform (CFT), Discrete Fourier Transform (DFT)
  + Sampling period, frequency lines, frequency grid
  + DFT of commonly used signals
  + **Aliasing** effect in time and in frequency domain, the Nyquist theorem, the leakage effect
* MATLAB
  + Computation of the DFT for a periodic signal
  + Working with amplitudes in dB
  + Construction of a time domain signal starting from the signal’s spectrum

# System Programming (C/C++)

Taught by Nastaran Nourbakhsh (nknourba@etrovub.be)

We discuss the following topics about programming in C/C++:

1. C++ Language Fundamentals
   1. What is C++?
   2. C++ and object-oriented programming
   3. Hello world!
   4. Working with variables, constants, enumerated constants
   5. Creating expressions and statements
   6. Conditional commands
   7. Organizing into functions
   8. Loops
2. Working with advanced functions
3. Understanding pointers
4. Function templates
5. Standard template library (STL)
   1. Containers and error handling
   2. Algorithms
   3. Lambda functions
6. Classes
   1. Constructors
   2. Copy assignment
   3. Destructor
   4. Static variables and members
7. Smart pointers

## Lecture 1 (3h)

Wed 2 Oct 2019 – 14:00-17:00 – K4.228

## Lecture 2 (3h)

Wed 9 Oct 2019 – 14:00-17:00 – K.4.228

## Lecture 3 (3h)

Wed 16 Oct 2019 – 14:00-17:00 – K.4.228

## Lecture 4 (3h)

Wed 23 Oct 2019 – 14:00-17:00 – K.4.228

## Lecture 5, 6 and 7 (3h) – Only if needed

Tue 29 Oct 2019 – 9:00-12:00 – K.4.228

Wed 30 Oct 2019 – 14:00-17:00 – K4.228

Thu 31 Oct 2019 – 13:00-16:00 – K.4.228

# Linear Algebra

Taught by Ivan Markovski (Ivan.Markovsky@vub.be) and  
Emanuele Garone (egarone@ulb.ac.be)

## Lecture 1 – Review of linear algebra (2h)

Tue 1 Oct 2019 – 15:00-17:00 – K.3.110(PC3)

* Linear functions and matrix–vector product
* Rank of a matrix and inversion
* Subspace, basis and dimension
* Eigen values and eigen vectors

## Lecture 2 - Applications (2h)

Tue 8 Oct 2019 – 15:00-17:00 – K.3.110(PC3)

* Least squares
* Least norm
* Singular value decomposition
* Low-rank approximation

## Lecture 3 - Exercises (2h)

Tue 15 Oct 2019 – 15:00-17:00 – K.3.110(PC3)

* MATLAB exercises based on theory

# Need help?

Contact information:

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I am a PhD student of the department ETRO, which is in turn part of the faculty of engineering (IR) at the VUB.

### Facebook group

Join the Facebook group for easier communication! Search for “BRUFACE MA1 EE (2019-2020)” or send an email to me and have me add you to the group.