



DIPARTIMENTO DI INGEGNERIA INDUSTRIALE

MATLAB SEMINARS – March 2021 Edition

The AAE programme, jointly with the PhD programme in Automotive Engineering organize three seminars dedicated to Matlab during the month of March 2021. Seminars will be held by Mathworks ambassadors Eng. Andrea Togni (andrea.togni3@unibo.it) and Eng. Andrea Nucci (andrea.nucci2@studio.unibo.it) and are scheduled for:

Date: March 19 h. 9-12

Title: Matlab Fundamentals

Teams Virtual room link: [Fai clic qui per partecipare alla riunione](#)

Date: March 19 h. 15-17

Title: Matlab Numerical Computing

Teams Virtual room link: [Fai clic qui per partecipare alla riunione](#)

Date: March 24 h 14-17

Title: MATLAB: A Practical Approach to Time Frequency Signal Analysis

TEAMS virtual room link: [Fai clic qui per partecipare alla riunione](#)

Contents of each seminar:

- **Matlab fundamentals**

Matlab Fundamentals - Basic commands - Vectors and Matrices - Modifying Arrays, Operations on Arrays - Calling a Built-In Function - Obtaining Help - Plotting Data - Matlab Scripts - Logical Expressions - Programming in Matlab – Debugging

- **Matlab numerical computing**

Numerical computing - Solving systems of linear equations - Solving systems of nonlinear equations - Numerical integration - Solving differential equations - Solving systems of differential equations - Symbolic computation

- **MATLAB: A Practical Approach to Time Frequency Signal Analysis**

This MathWorks online seminar is open to any student of University of Bologna and Motorvehicle University of Emilia Romagna who wants to obtain a broader view on the topic of signal analysis and processing. The seminar will be divided in three topical segments, from the general problem of frequency representation to the specific case of non-stationary signals. The first part of the seminar will introduce the topic of analysis in the frequency domain, describing the reasons behind this approach and the usual objectives achieved by using this representation. During this introduction we will discuss the main results of employing the



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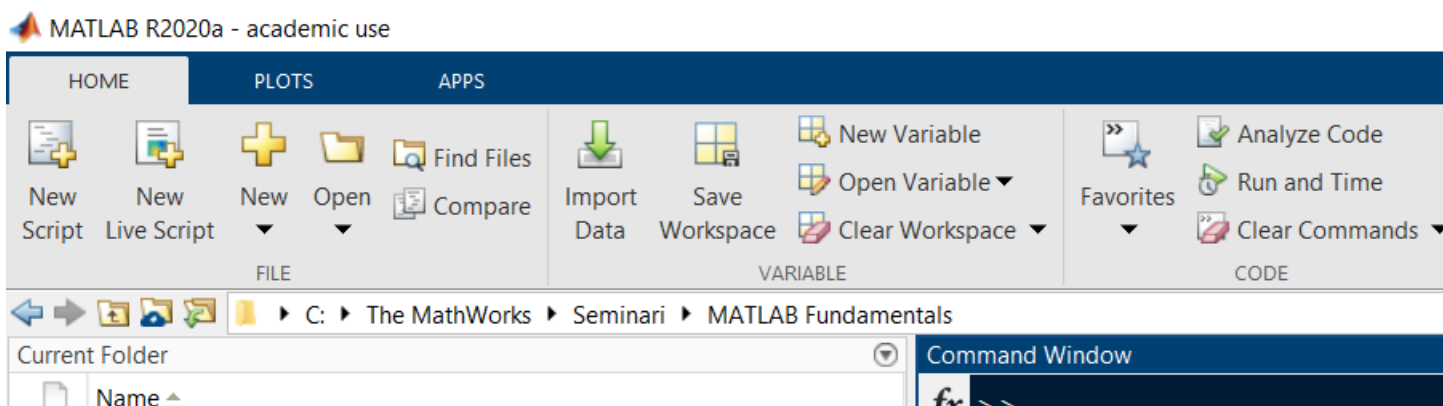
Discrete Fourier Transform to ideal and real-life signals, as well as equivalent ways of representing signals in the time, frequency, and complex domain to give the attendees a better insight on the nature of the transformations employed.

In the second segment we will focus our attention on the most practical limitation of the Fourier Transform: the non-stationarity of signals. We will see how this limit is overcome by the employment of alternative algorithms, and how the transformation in the frequency domain can be generalized to a time-frequency plane. This more general approach provides greater versatility when analyzing signals, and we will see how the results of these methods can be used to estimate important characteristics of the data under analysis.

The third and final part of the seminar will proceed to apply the previously discussed concepts by simulating data and acquisition systems using the software MATLAB. This practical part will cover both simulated and case-study datasets from different fields of Information and Industrial Engineering. We will see how the obtained spectra are strongly dependent on the acquisition parameters and the signal characteristics, and we will apply the appropriate digital filters to compensate for undesired effects, as well as introduce acquisition strategies to overcome the usual limitations.

IMPORTANT NOTES:

- In order to download Mathworks software please check this webpage: [MATLAB Access and Support for Everyone at ALMA MATER STUDIORUM](#).
 - Detailed info could be found here [MATLAB Licenza Campus UNIBO](#)
 - We advise students to check the following Toolbox while installing Matlab HOME>Add-Ons>Manage Add-Ons (see screenshot below)
- Symbolic Math Toolbox
 - Optimization Toolbox



Any additional information could be requested to the Matlab Ambassadors