

# BLM2041 Signals and Systems

## Syllabus

### The Instructors:

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# Course Details

- Course Code : BLM 2041
- Course Name:  
Signals and Systems for Computer Engineers  
(Bilgisayar Mühendisleri için Sinyaller ve Sistemler)

Instructor :

- 1- Dr. Öğr. Üyesi Ali Can Karaca
- 2- Öğr. Gör. Dr. Ahmet Elbir

# Assesment

Method	Quantity	(%)
Quiz	1	10
Homework	3	20
Midterm Exam(s)	1	30
Final Exam	1	40
Attendance & participation	-	00

By University Rule:

Your average  $< 40$



FF

# Course Outline

## **1. Introduction.**

Mathematical Representation of Signals. Mathematical Representation of Systems.

## **2. Sinusoids.**

Review of Sine and Cosine Functions. Sinusoidal Signals. Sampling and Plotting Sinusoids. Complex Exponentials and Phasors. Phasor Addition. Time Signals.

## **3. Spectrum Representation.**

The Spectrum of a Sum of Sinusoids. Beat Notes. Periodic Waveforms. Fourier Series Analysis and Synthesis. Time-Frequency Spectrum. Frequency Modulation.

## **4. Sampling and Aliasing.**

Sampling. Spectrum View of Sampling and Reconstruction. Discrete-to-Continuous Conversion. The Sampling Theorem.

## **5. Continuous-Time LTI Systems and the Convolution Integral.**

Establishing a General Input-Output Relationship. Working with the Convolution Integral.

## **6. Discrete-Time LTI Systems and the Convolution Sum.**

Specializing the Input/Output Relationship. Working with the convolution Sum.

## **7. LTI System Differential and Difference Equations in the Time Domain.**

Obtaining the differential/difference equations for the input-output relations of systems. Solution of differential and discrete equations in the time domain.

# Course Outline

## **8. The Fourier Transform for Continuous-Time Signals and Systems.**

Continuous-Time Aperiodic Signals. Continuous-Time Fourier Transform. Properties of Continuous-Time Fourier Transform.

## **9. The Discrete Time Fourier Transform for Discrete-Time Signals.**

Discrete-Time Aperiodic Signals. Discrete-Time Fourier Transform. Properties of Discrete-Time Fourier Transform

## **10. The Laplace Transform for Continuous Time.**

Laplace Transform. Common Laplace Transforms. Properties Of the Laplace Transform. Inverse Laplace Transform. Poles and Zeros in the s-plane.

## **11. The Z Transform for Discrete Time.**

Z Transform. Common Z Transforms. Properties Of the Z Transform. Inverse Z Transform. Poles and Zeros in the z-plane.

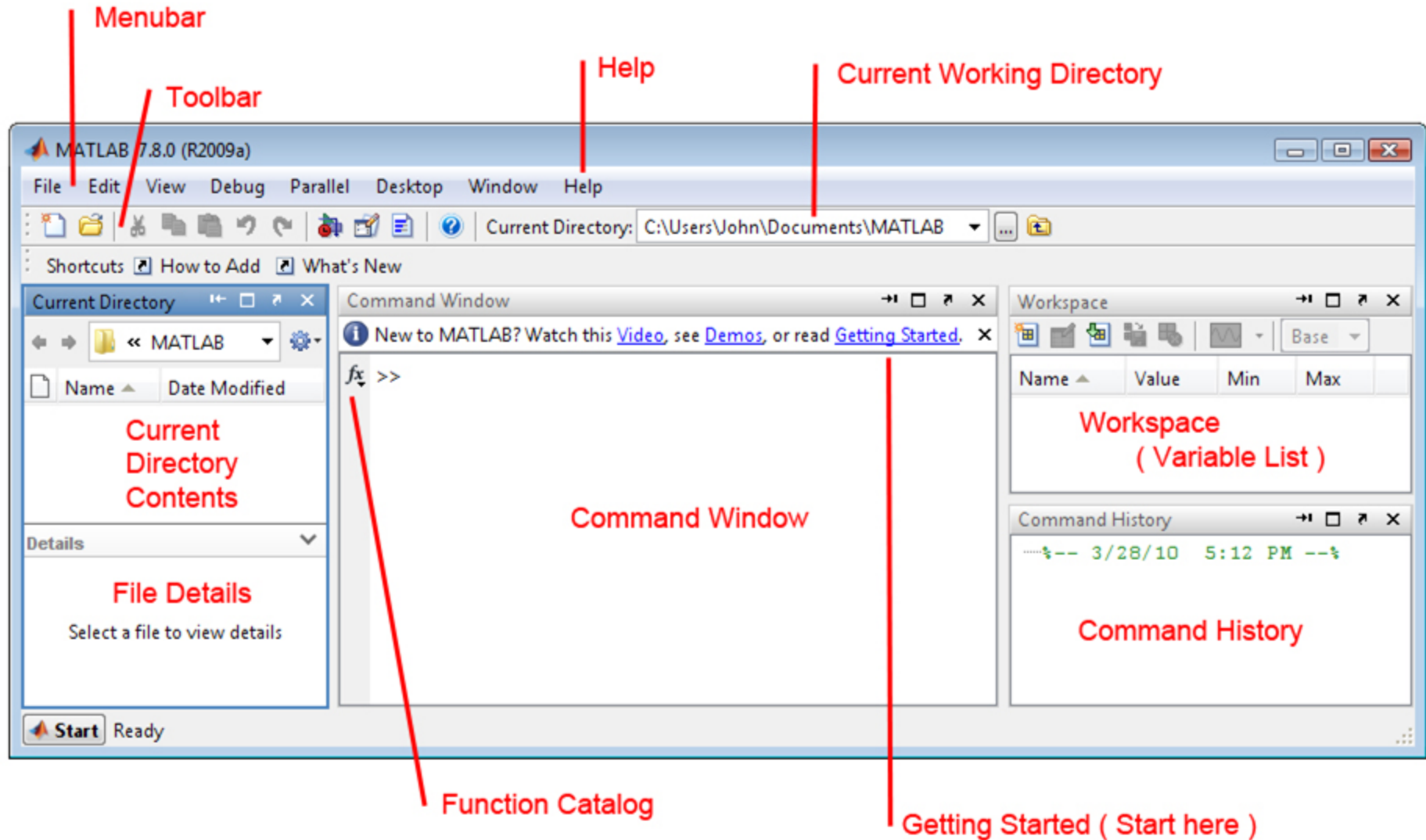
# COURSE OBJECTIVES

- Students will be able to:
- Understand **mathematical** descriptions of Signals and Systems
- Express those descriptions as computer **implementations** (MATLAB, OCTAVE, SCILAB, R, PYTHON )
  - Yıldız Technical University provides MATLAB License.
  - OCTAVE, SCILAB, R and PYTHON are free

# COURSE OBJECTIVES

- MATLAB
  - <https://www.mathworks.com/>
- SCILAB
  - <https://www.scilab.org/>
- OCTAVE
  - <https://www.gnu.org/software/octave/>
- R
  - <https://www.r-project.org/>
- PYTHON
  - <https://www.python.org/>

# MATLAB environment





# SCILAB environmet

The screenshot displays the SCILAB environment interface, which includes a file navigator, a central console, and a variable navigator.

**Console Scilab:**

```

Initialisation :
Chargement de l'environnement de travail

-->a=rand(10,10)
a =

    column 1 to 5

    0.2113249    0.5608486    0.3076091    0.5015342    0.2806498
    0.7560439    0.6623569    0.9329616    0.4368588    0.1280058
    0.0002211    0.7263507    0.2346008    0.2693125    0.7783129
    0.3303271    0.1985144    0.312642    0.6325745    0.2119030
    0.6653811    0.5442573    0.3616361    0.4051954    0.1121355
    0.6283918    0.2320748    0.2922267    0.9184708    0.6856896
    0.8497452    0.2312237    0.5664249    0.0437334    0.1531217
    0.6857310    0.2164633    0.4826472    0.4818509    0.6970851
    0.8782165    0.8833888    0.3321719    0.2639556    0.8415518
    0.0683740    0.6525135    0.5935095    0.4148104    0.4062025

    column 6 to 10

    0.4094825    0.3873779    0.5376230    0.5878720    0.6488563
    0.8784126    0.9222899    0.1199926    0.4828179    0.9923191
    0.1138360    0.9488184    0.2256303    0.2232865    0.0500420
    0.1998338    0.3435337    0.6274093    0.8400886    0.7485507
    0.5618661    0.3760119    0.7608433    0.1205996    0.4104059
    0.5896177    0.7348941    0.0485566    0.2855364    0.4084526
    0.6853980    0.2615761    0.6723950    0.8607515    0.8544211
    0.8906225    0.4993494    0.2017173    0.8494102    0.0642647
    0.5042213    0.2638578    0.3911574    0.5257061    0.8279083
    0.3493615    0.5253563    0.8380317    0.9931210    0.9262344

-->
    
```

**Navigateur de variables:**

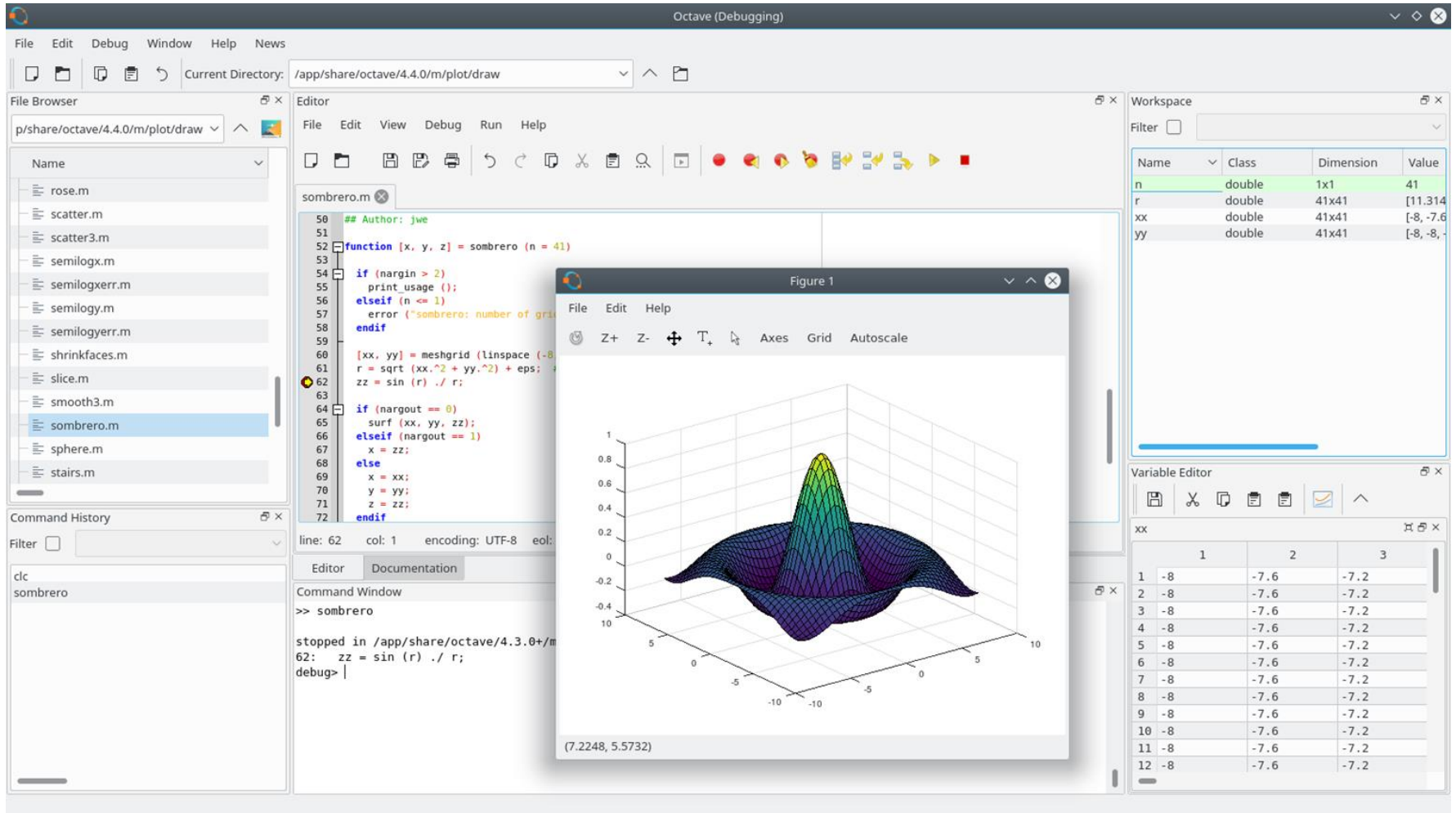
Nom	Dimension	Type	Visibilité
a	10x10	Double local	
home	1x1	Chaine de... local	
PWD	1x1	Chaine de... local	
%tk	1x1	Boolean local	
%f	1x1	Boolean local	
%T	1x1	Boolean local	
%nan	1x1	Double local	
%inf	1x1	Double local	
%CI	1x1	Chaine de... local	
%HOME	1x1	Chaine de... local	
%TMPDIR	1x1	Chaine de... local	
%gui	1x1	Boolean local	
%fftw	1x1	Boolean local	
%t	1x1	Boolean local	
%f	1x1	Boolean local	
%eps	1x1	Double local	
%io	1x2	Double local	
%i	1x1	Double local	
%e	1x1	Double local	
%pi	1x1	Double local	
%modaWa...	1x1	Boolean global	
%toolboxes	1x1	Double global	
%toolboxe...	1x1	Chaine de... global	

**Historique des commandes:**

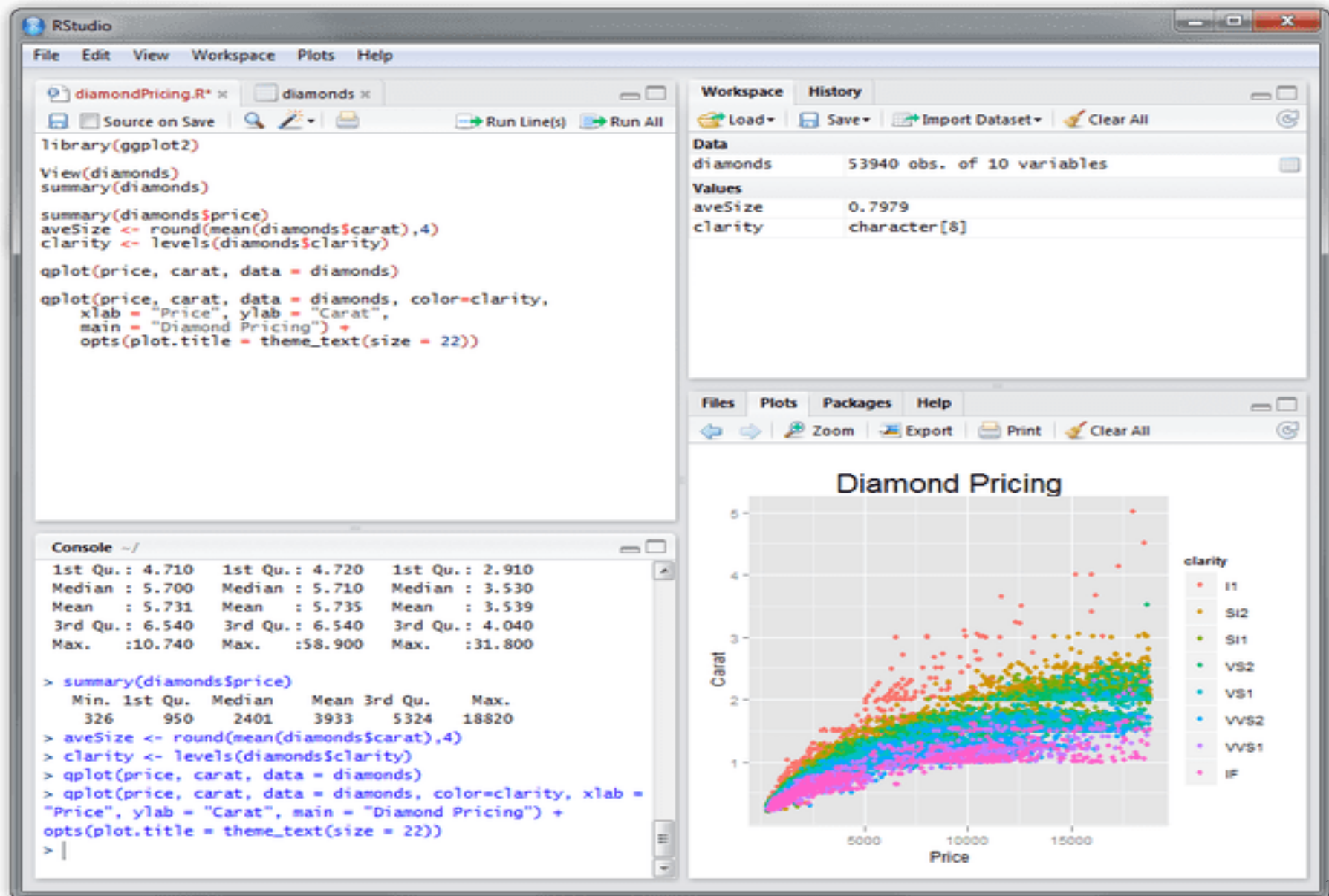
```

> // -- 29/08/2012 09:25:18 -- //
> // -- 29/08/2012 11:36:14 -- //
a=rand(10,10)
    
```

# OCTAVE environment



# Rstudio (IDE for R)



# Spyder (IDE for PYTHON)

The screenshot displays the Spyder Python IDE interface. The top menu bar includes File, Edit, Search, Source, Run, Debug, Consoles, Projects, Tools, View, and Help. Below the menu is a toolbar with icons for file operations and execution. The main window is divided into three panes:

- Editor:** Displays a Python script named `tmm_core.py`. The code defines a function `position_resolved` that calculates the Poynting vector, absorbed energy density, and E-field at a specific location. The function takes parameters `layer`, `distance`, and `coh_tmm_data`. The code is currently at line 405.
- Help:** Displays the documentation for the `coh_tmm` module. It includes the definition `coh_tmm(pol, n_list, d_list, th_0, lam_vac)` and a description of the main "coherent transfer matrix method" calculation. It also lists the parameters: `pol` (light polarization), `n_list` (list of refractive indices), `th_0` (angle of incidence), and `lam_vac` (vacuum wavelength).
- IPython console:** Shows the execution of the code. The console output includes the results of the `coh_tmm` function call and the calculation of the phase of the E-field.

The status bar at the bottom indicates the current file permissions (RW), end-of-line (CRLF), encoding (UTF-8), and the current position (Line 405, Column 11, Memory 47 %).

# Course Objectives (In details)

## Academic knowledge

- Students will be able to:
  - Understand and develop simple mathematical models for representing signals and systems
  - Understand the relationship between time and frequency domain models of dynamic systems
  - Convert time to frequency-domain models and vice versa
  - Understand the relationship between continuous and discrete-time models

## Intellectual skills

- Students will be able to:
  - Build a mathematical model from a real-life problem related to signals and systems
  - Interpret results achieved by mathematical solutions

## Practical skills

- Students will be able to:
  - Express models and methods as computer implementations (MATLAB or OCTAVE)
    - Yıldız Technical University provides MATLAB License.
  - Apply Matlab/Octave for analysis and simulation of continuous and discrete time systems
  - Analyse mathematical solutions in the context of the original problem

## Transferable skills

- Students will be able to:
  - Choose appropriate approach in problem solving situation
  - Present and communicate formalised results and conclusions



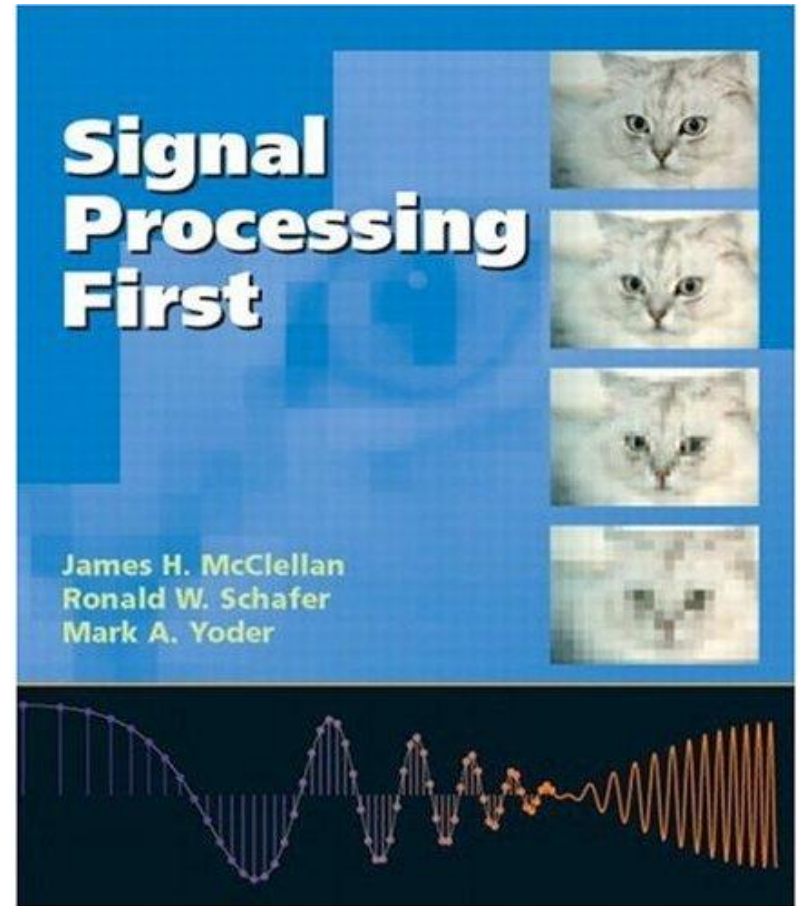
# Main course book

## Signal Processing First

by James H McClellan,  
Ronald W. Schaffer  
and Mark A. Yoder.

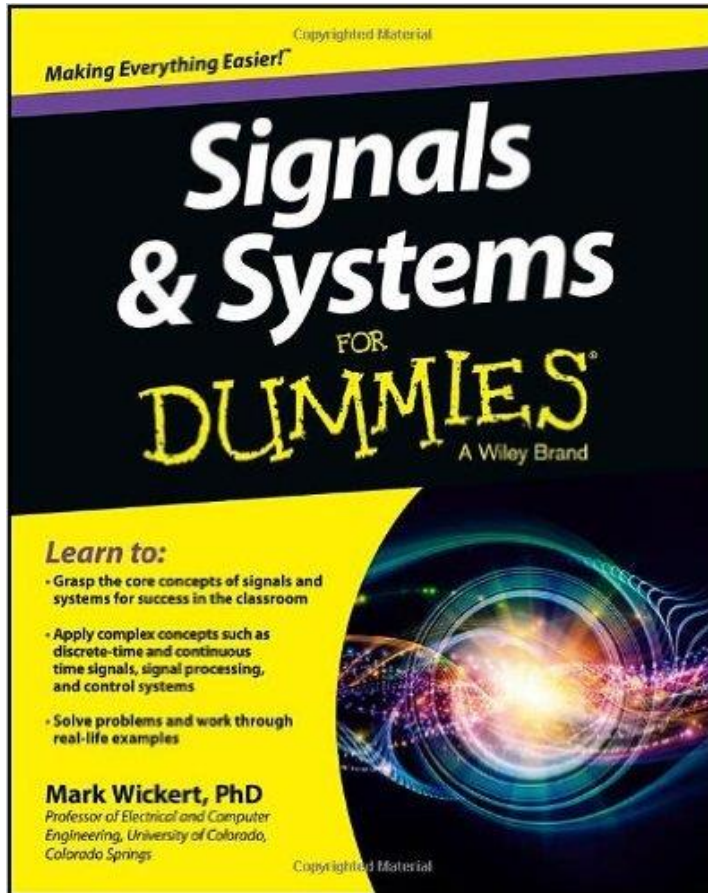
Published by Prentice  
Hall.

Isbn: 0-13-120265-0



# Some Other Books

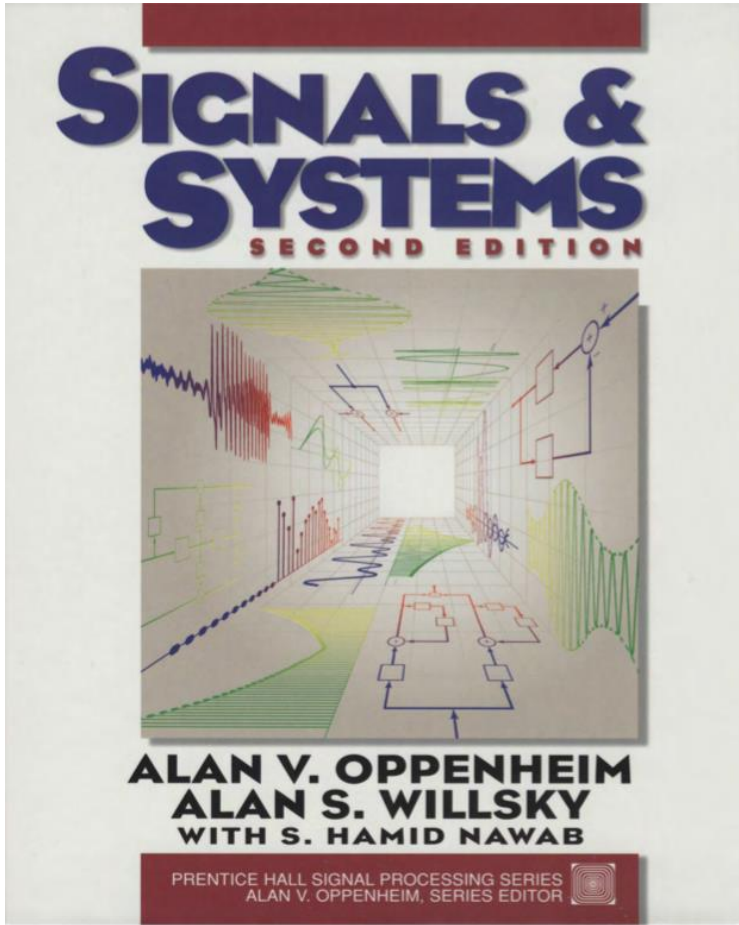
- by Mark Wickert



Wickert, Mark. *Signals and Systems for Dummies*. John Wiley & Sons, 2013.

# Some Other Books

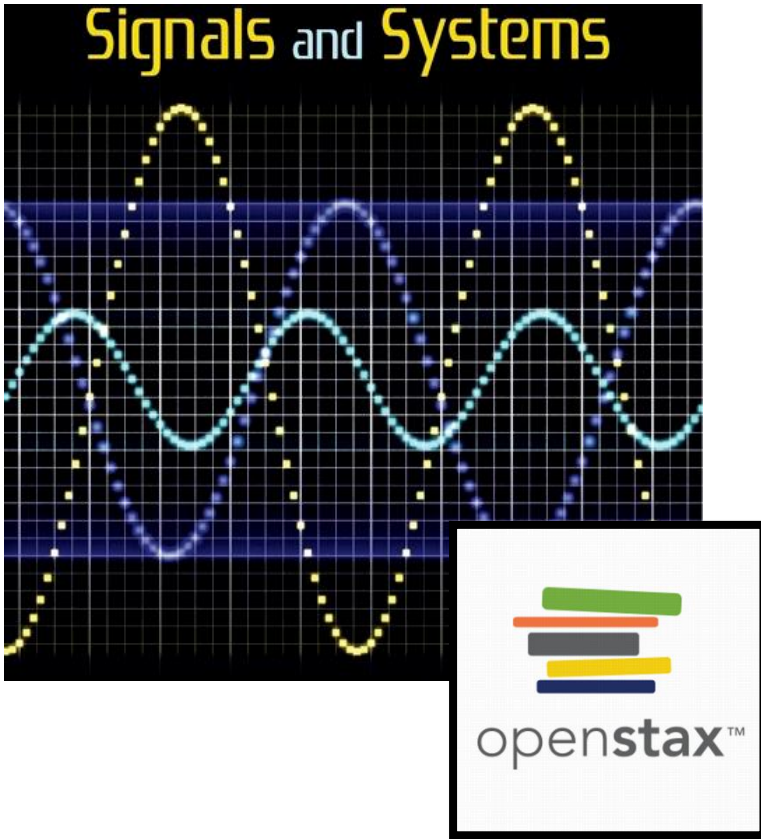
- by [Alan. V. Oppenheim](#) and [Alan S. Willsky](#)



Oppenheim, Alan V., Alan S. Willsky, and Syed Hamid Nawab. "Signals and systems 2nd ed." *New Jersey: Prentice Hall*(1997).



# Some Other Books



- Online e-book by [Richard Baraniuk](#)

<https://cnx.org/contents/d2CEAGW5>

# Rules of the Conduct

- No eating /drinking in class
  - *except water*
- Cell phones must be kept outside of class or switched-off during class
  - *If your cell-phone rings during class or you use it in any way, you will be asked to leave and counted as unexcused absent.*
- No web surfing and/or unrelated use of computers,
  - *when computers are used in class or lab.*

# Rules of the Conduct

- You are responsible for checking the class web page often for announcements.
- Academic dishonesty and cheating will not be tolerated and will be dealt with according to university rules and regulations
  - *Presenting any work, or a portion thereof, that does not belong to you is considered academic dishonesty.*
- University rules and regulations:
  - <http://www.ogi.yildiz.edu.tr/category.php?id=17>
  - [https://www.yok.gov.tr/content/view/544/230/lang,tr\\_TR/](https://www.yok.gov.tr/content/view/544/230/lang,tr_TR/)

# Attendance Policy

- The requirement for attendance is **70%**.
  - *Hospital reports are not accepted to fulfill the requirement for attendance.*
  - *The students, who fail to fulfill the attendance requirement, will be excluded from the final exams and the grade of **F0** will be given.*
  - **Absent more than 12 hours ☐ F0**

# Seeing the Big Picture

## Getting Started with Signals and Systems

## Exploring the Time Domain

## Picking Up the Frequency Domain

## Entering the $s$ - and $z$ -Domains

