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	-	00
Homework	3-4	25
Midterm Exam(s)	1	35
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 euations 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.

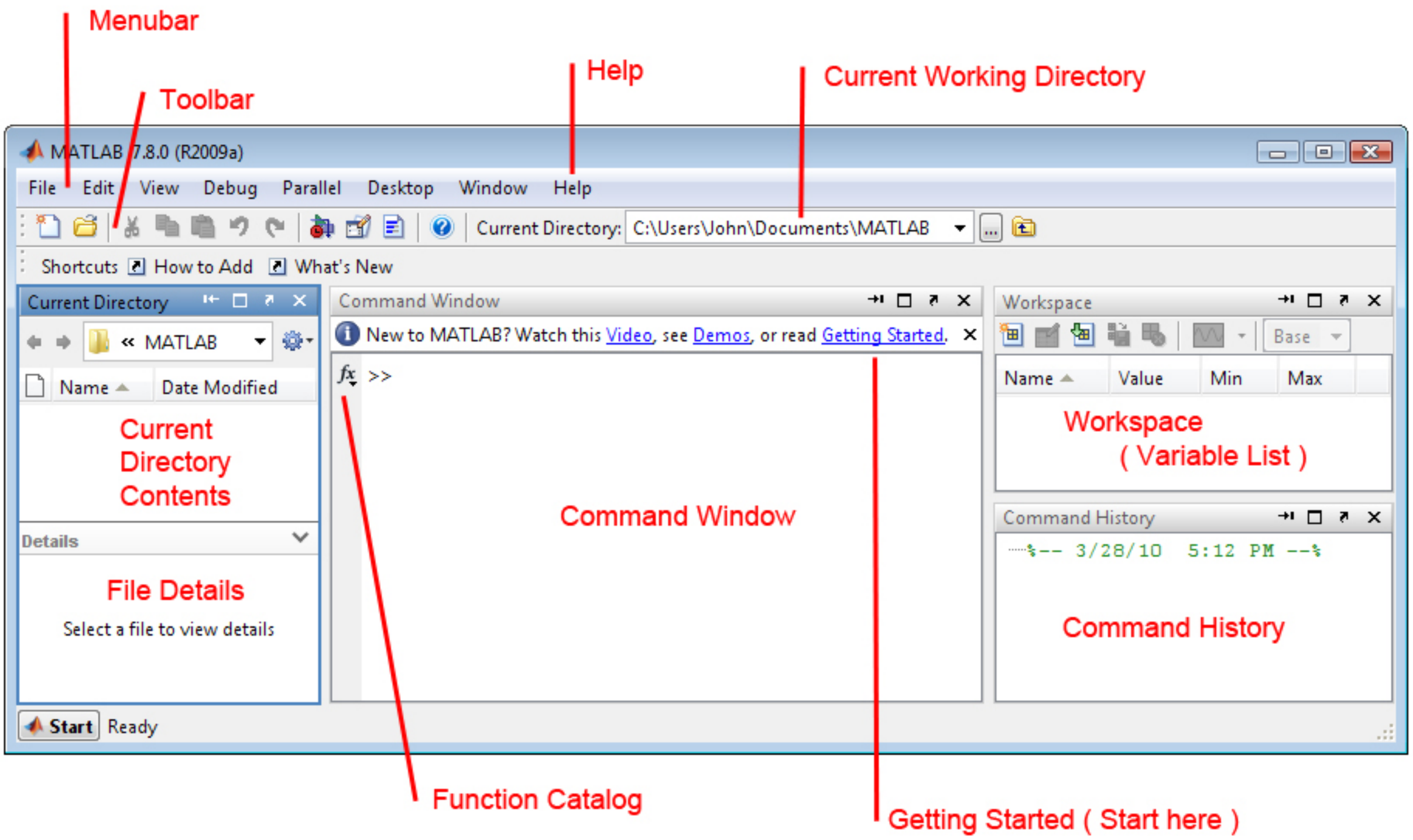
COURSE OBJECTIVES

- 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

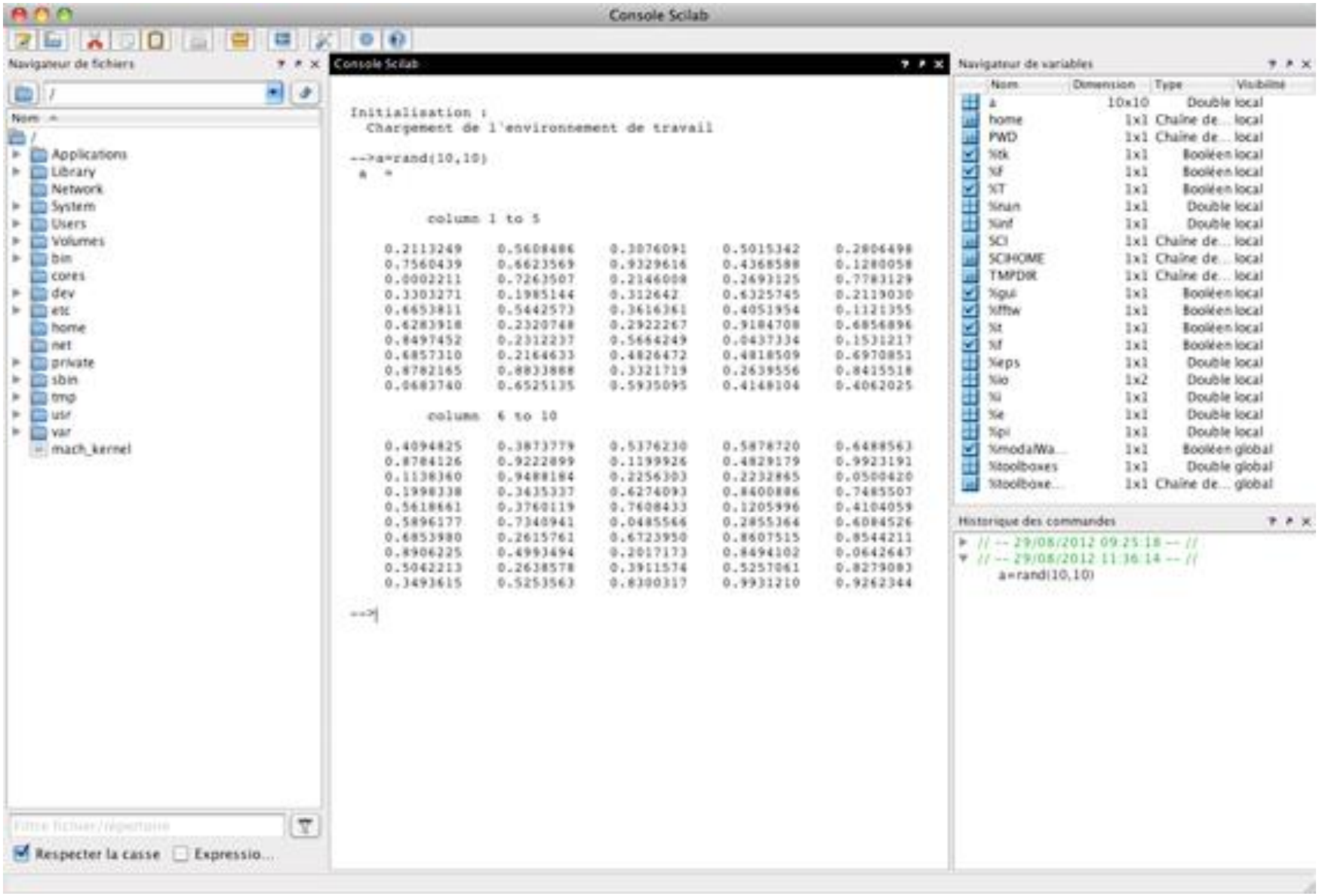
COURSE OBJECTIVES

- 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/

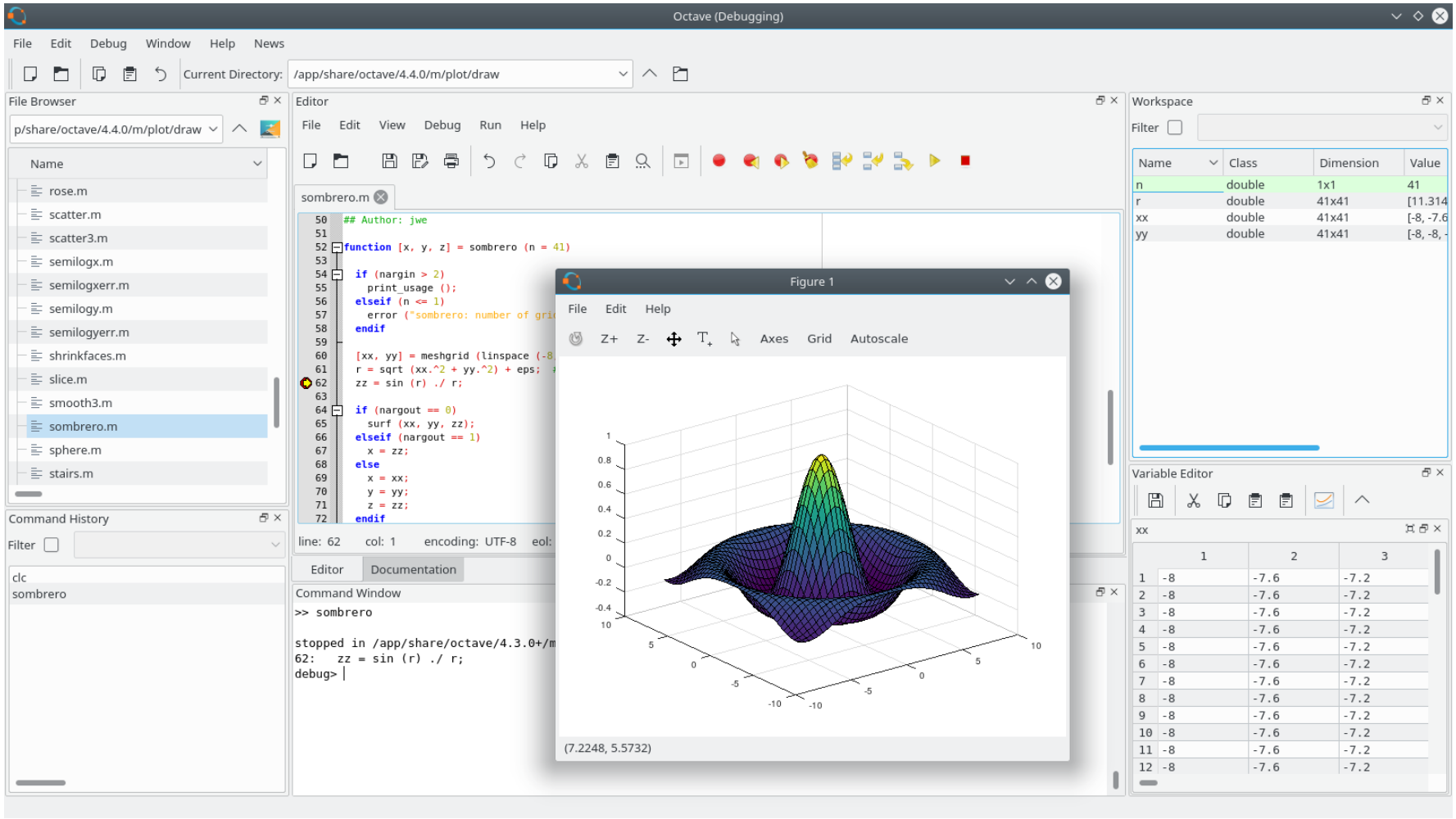
MATLAB environment



SCILAB environmet



OCTAVE environment



Rstudio (IDE for R)

RStudio

File Edit View Workspace Plots Help

diamondPricing.R* | diamonds

Source on Save | Run Line(s) | Run All

```
library(ggplot2)

View(diamonds)
summary(diamonds)

summary(diamonds$price)
aveSize <- round(mean(diamonds$carat),4)
clarity <- levels(diamonds$clarity)

qplot(price, carat, data = diamonds)

qplot(price, carat, data = diamonds, color=clarity,
    xlab = "Price", ylab = "Carat",
    main = "Diamond Pricing") +
    opts(plot.title = theme_text(size = 22))
```

Workspace | History

Load | Save | Import Dataset | Clear All

Data	
diamonds	53940 obs. of 10 variables
Values	
aveSize	0.7979
clarity	character[8]

Files | Plots | Packages | Help

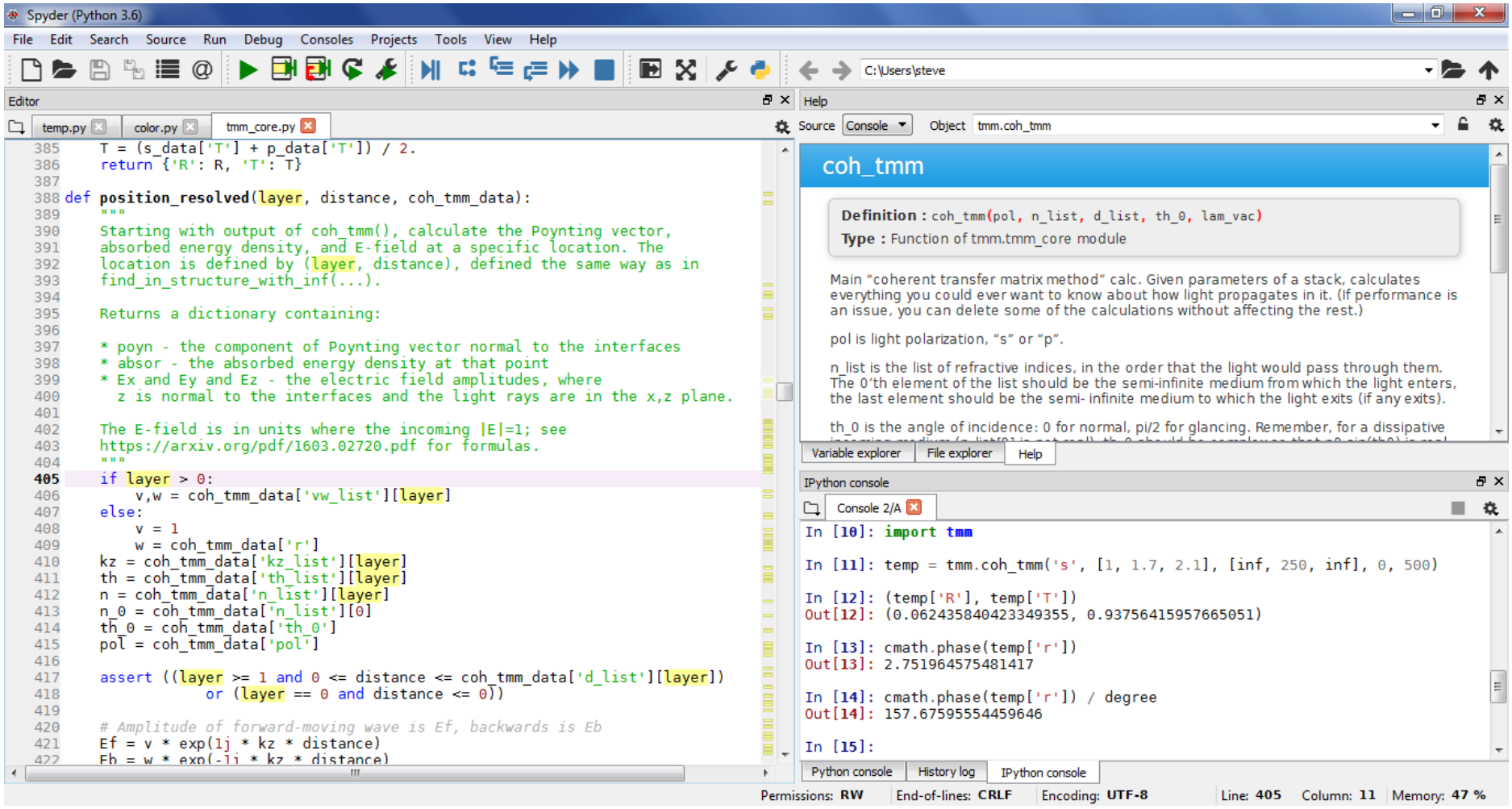
Zoom | Export | Print | Clear All

Console ~/

```
 1st Qu.: 4.710   1st Qu.: 4.720   1st Qu.: 2.910
 Median : 5.700   Median : 5.710   Median : 3.530
 Mean   : 5.731   Mean   : 5.735   Mean   : 3.539
 3rd Qu.: 6.540   3rd Qu.: 6.540   3rd Qu.: 4.040
 Max.   :10.740   Max.   :58.900   Max.   :31.800

> summary(diamonds$price)
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
    326     950    2401    3933    5324   18820
> aveSize <- round(mean(diamonds$carat),4)
> clarity <- levels(diamonds$clarity)
> qplot(price, carat, data = diamonds)
> qplot(price, carat, data = diamonds, color=clarity, xlab =
"Price", ylab = "Carat", main = "Diamond Pricing") +
opts(plot.title = theme_text(size = 22))
>
```

Spyder (IDE for PHYTHON)



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

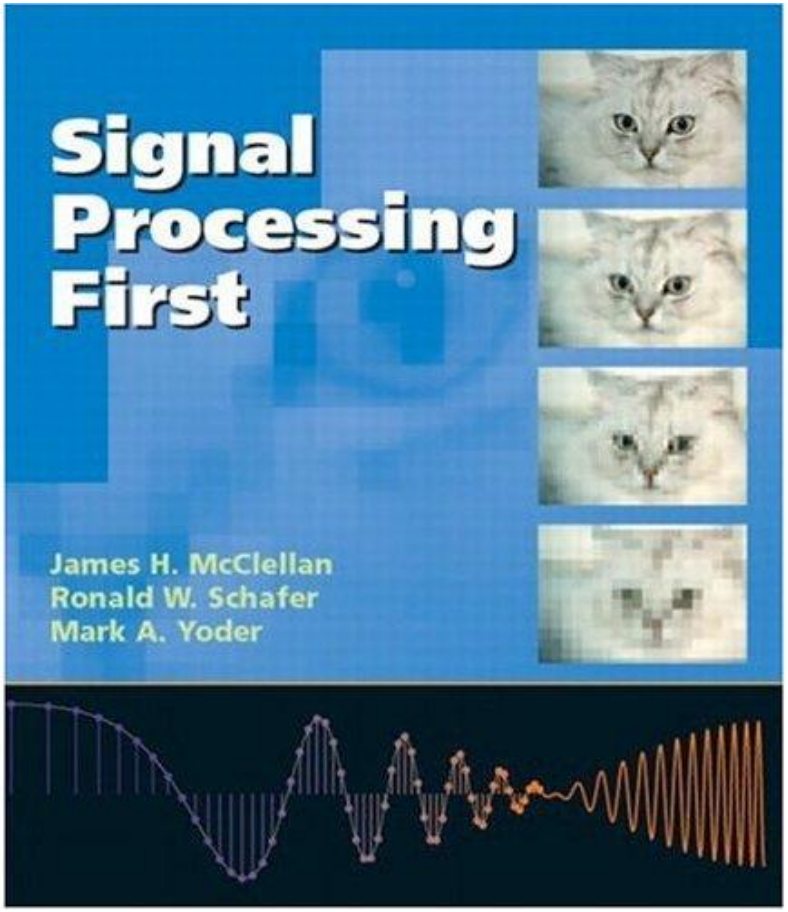
Main course book

Signal Processing First

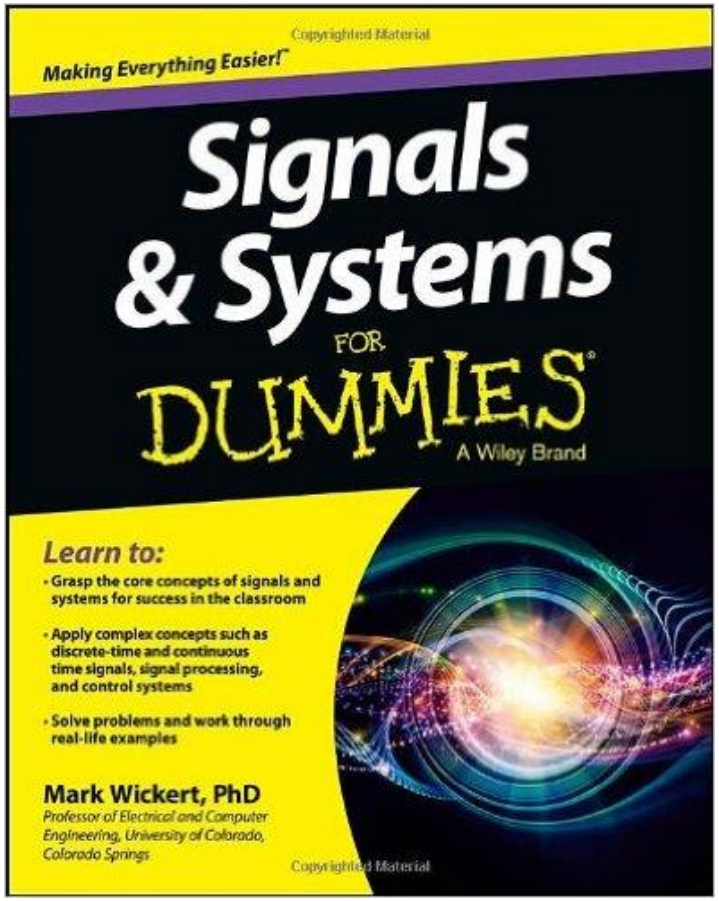
by James H McClellan, Ronald W. Schaffer and Mark A. Yoder.

Published by Prentice Hall.

Isbn: 0-13-120265-0



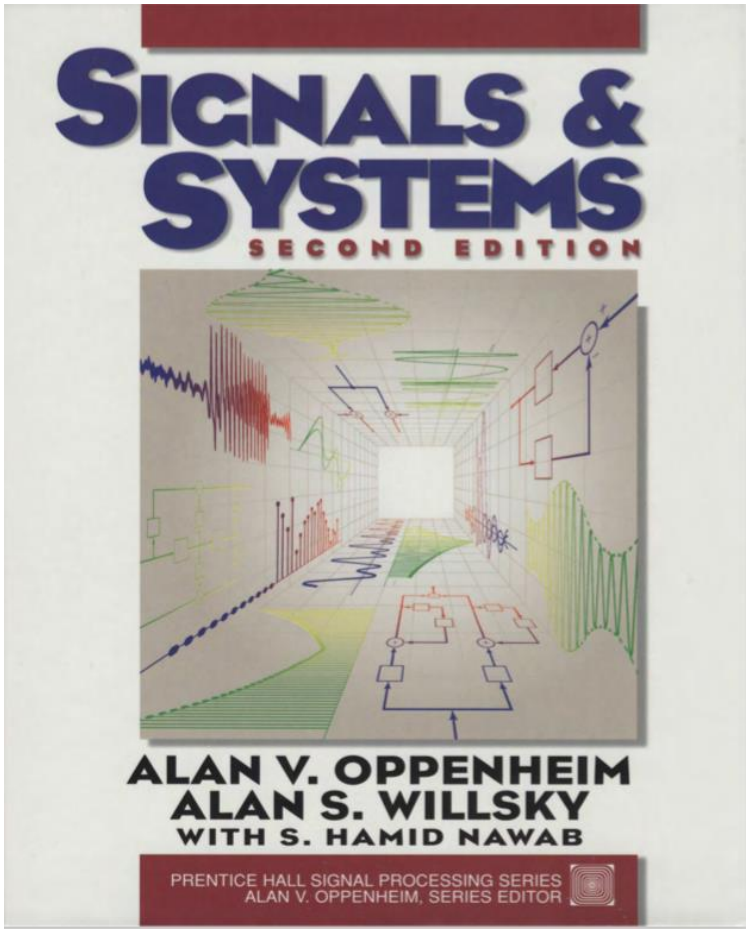
Some Other Books



- 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/

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