



# Signal Processing

FIGEN S. OKTEM

# General Remarks

- ▶ Signal processing is a branch of electrical engineering that models and analyzes data representations of physical events (according to IEEE Signal Proc. Society).
- ▶ Signal processing is at the heart of our modern world, powering today's and tomorrow's technology for the generation, transformation, and interpretation of information.
  - Signal: Variation of a physical, or non-physical, quantity (**function** in math), contains information about the behavior of some process
  - System: Any process/device that transforms signals

# Requirements of SP Option

## ► Core courses:

- ❖ EE430 Digital Signal Processing (*offered in Fall & Spring*)
- ❖ EE499 Vector Space Methods in Signal Processing (*offered in Fall*)
- ❖ EE432 Real-time Applications of DSP (*offered in Spring*)

## ► Electives:

- ❖ Any three, fourth year EE courses except EE475 and EE476
- ❖ At least one of them must have laboratory work to complete the laboratory requirement of the department

# Info about Core Courses

- ▶ EE430 Digital Signal Processing (DSP)
  - ❖ Fundamentals of discrete-time signal processing (sampling, interpolation, DFT, FFT, filter design techniques, ...)
- ▶ EE499 Vector Space Methods in Signal Processing
  - ❖ Unified treatment of mathematics prevalent in SP (including linear algebra, probability theory, and optimization) with applications to important SP problems (denoising, deconvolution, compression, smoothing, prediction, ...)
- ▶ EE432 Real-time Applications of DSP
  - ❖ Fundamentals of real-time DSP (design of SP systems on an embedded platform - myRIO - using Matlab, LabVIEW and C, applications such as spectrum analysis, decimation/interpolation, optimal filtering, system identification with adaptive proc., image proc.,...)

# SP Research at METU

- ❖ multimedia signal processing (all aspects: speech, audio, image and video processing)
- ❖ image analysis, pattern recognition, machine vision
- ❖ estimation theory, inverse problems
- ❖ machine learning and data science ('big data')
- ❖ radar signal processing (including SAR imaging and STAP techniques), sensor array and multichannel signal proc.
- ❖ spectrum estimation techniques, direction of arrival estimation methods
- ❖ computational imaging and optical processing
- ❖ signal processing for communications
- ❖ ...

# METU Faculty Members

- ▶ Akar, Gözde Bozdağı (image, video proc.)
- ▶ Alatan, Aydin (image, video proc., pattern recognition, machine vision)
- ▶ Baykal, Buyurman (statistical signal proc., radar signal proc.)
- ▶ Candan, Çağatay (statistical signal proc., radar signal proc.)
- ▶ Çiloğlu, Tolga (statistical signal proc., speech and acoustic signal proc.)
- ▶ Kamışlı, Fatih (image, video proc., compression)
- ▶ Koç, Arzu (spectrum estimation, direction-of-arrival estimation)
- ▶ Orguner, Umut (statistical signal proc., Kalman filtering, target tracking)
- ▶ Öktem, Sevinç Figen (statistical multidimensional signal proc., inverse problems, computational imaging, optical information processing)
- ▶ Özkan, Emre (statistical signal proc., estimation theory, sensor fusion, Monte Carlo methods)
- ▶ Tuncer, Engin (sensor array and multichannel signal proc.)
- ▶ Vural, Elif (statistical signal and image proc.)

# METU Graduate Courses

**EE 503** : Statistical Signal Processing and Modeling

**EE 5506** : Advanced Statistical Signal Processing

**EE 504** : Adaptive Filtering (Pre-requisite: 503)

**EE 505** : Wavelets, Filterbanks, Time-Frequency Distributions

**EE 531** : Probability and Stochastic Processes

**EE 543** : Neurocomputers and Deep Learning

**EE 583** : Pattern Recognition

**EE 584** : Machine Vision

# METU Graduate Courses (Cont'ed)

**EE 603** : Spectrum Estimation

**EE 604** : Sensor Array Signal Processing

**EE 633** : Speech Processing

**EE 634** : Image Processing

**EE 636** : Video Processing

**EE 732** : Probabilistic Graphical Models

**EE 746** : Radar Signal Processing

**EE 798** : Theory of Remote Image Formation

## More information about SP?

- ▶ Visit the website of METU SP Group
- ▶ Visit the website of IEEE Signal Processing Society
- ▶ Check the following videos:  
What is Signal Processing?  
Signal Processing and Machine Learning  
The Future of Signal Processing