Electrical and Electronics Engineering Department, METU
EE769 SENSOR ARRAY SIGNAL PROCESSING

Spring 2008

Description:

The objective of this course is to present the theoretical and practical aspects of three important applications of array signal processing, namely, direction-of-arrival estimation, beamforming, and source localization. The material that is covered in this course will let the graduate student to have the sufficient background to do research and contribute in these fields. Students will have the background on array models, assumptions, performance bounds, both classical and superresolution techniques of direction-of-arrival estimation, array mapping, wideband processing, beamforming, localization and calibration.

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Course Outline

1.	Introduction, Array geometry and mathematical model,
2.	Narrowband model and assumptions, Performance analysis
3.	Cramer Rao Bound, Practical methods of direction of arrival
4.	Watson-Watt, Interferometer, Pseudo-Doppler techniques
5.	Optimum and close to optimum methods of direction of arrival estimation,
6.	Maximum likelihood methods, MUSIC methods, ESPRIT, Min-Norm methods
7.	Beamspace processing, Delay-and-sum beamforming, Filter-and-sum beamforming,
8.	MVDR beamforming ,Virtual Array Processing, Davies's transformation
9.	Array Interpolation
10.	Wideband model
11.	Coherent and Noncoherent Wideband Processing
12.	Source localization
13.	Triangularization, time-difference of arrival technique
14.	Calibration

Grading: Midterm: %20, Final : %30, Homeworks: %10, Project: %40

Textbooks:
1. Harry L. Van Trees, *Optimum Array Processing*, John Wiley & Sons, Inc., NY, 2002.
2. Sathish Chandran, *Advances in direction-of-arrival estimation*, Artech House, Inc., 2006.

Reference Materials
1. Don. H. Johnson, Dan. E. Dudgeon, *Array Signal Processing: Concepts and techniques*, Prentice Hall, 1993.
2. Richard A. Poisel, *Electronic Warfare Target Location Methods*, Arctech House, 2005.
3. Jian Ji, Petre Stoica, *Robust Adaptive Beamforming*, Prentice Hall, 2005.
4. Petre Stoica, Randolph Moses, *Spectral Analysis of Signals*, Prentice Hall, 2005.
5. Several papers related to the topics in the course outline.