

Class Meeting Location STD CENTER B228C
Class Meeting Times TH B3,TU B3

Instructor ALPER ERDOĞAN
Office Hours Thursday 10:00
Office Location ENG 221
Office Phone
Email alperdogan@ku.edu.tr
Web Address http://aspc.ku.edu.tr

Number of Credits 3
ECTS Credits 6
Prerequisites consent of the instructor
Language English

Assistant

N/A

Course Description

Hypothesis Testing, Signal Detection, Parameter Estimation, Cramer-Rao Lower Bound, Maximum Likelihood/ Maximum a Posteriori Estimation, Stochastic Least Squares Estimation and Kalman Filtering.

Course Objectives

Main objective is to provide basic estimation and detection background for engineering applications. After taking this course, students should have enough understanding of the main concepts and algorithms of detection and estimation theory for practical applications as well as for their research.

Learning Outcomes

1. Learn about basic Estimation Methods: Maximum Likelihood Estimation, Maximum A Posteriori Estimation, Minimum Variance Unbiased Estimation, Minimum Mean Square Error Estimation, Linear Minimum Mean Square Error Estimation and Kalman Filtering
2. Learn about basic estimator properties such as Bias, Efficiency, Linearity
3. Learn Classical and Bayesian Estimation Approaches
4. Learn Basic Estimation Performance Bounds such as Cramer-Rao Bound
5. Gain ability to apply estimation methods to real engineering problems.

Teaching Methods

The course duration is 14 weeks and each week will contain two 75 minute lectures. The instructor will mainly use the board to deliver lectures.

The students will be regularly assigned homework exercises. There will be one midterm and one final exam.

Course Contents

Session Number	Starting Date	Topics
1	04/02/2014	Introduction and Motivation
4	06/02/2014	Probability Review
1	20/02/2014	Estimation Problem
1	25/02/2014	Minimum Variance Unbiased Estimation
1	27/02/2014	Existence of MVUB Estimators
1	04/03/2014	Cramer Rao Lower Bound- Scalar Case
1	06/03/2014	Fisher Score and Information, Derivation of CRLB

1	11/03/2014	Derivation of Vector CRLB, CRLB for transformation of variables
1	13/03/2014	Some Matrix Calculus Results
1	18/03/2014	CRLB for Gaussian Model
1	20/03/2014	Asymptotic CRLB for WSS Gaussian Random Processes
1	24/03/2014	Examples of CRLB
1	27/03/2014	Minimum Variance Estimators for Linear Additive White Gaussian Noise Models
1	01/04/2014	Sufficient Statistics and Neyman-Fisher Factorization
1	03/04/2014	Using Sufficiency to find Minimum Variance Unbiased Estimators
1	08/04/2014	Spring Break
1	10/04/2014	Spring Break
1	15/04/2014	Best Linear Unbiased Estimators
1	17/04/2014	Maximum Likelihood Estimation
1	22/04/2014	Determining Maximum Likelihood Estimators
1	24/04/2014	Bayesian Estimation
1	29/04/2014	Conditional Gaussian PDF and Bayesian Linear Model
1	01/05/2014	Bayesian Risk and Maximum A Posterior Estimation
1	06/05/2014	Stochastic Least Squares: Introduction
1	08/05/2014	Stochastic Least Squares: Random Vectors
1	13/05/2014	Wiener Filtering and Smoothing
1	15/05/2014	Kalman Filtering

Assessment Methods

Type	Description	Final Grade, %
Final Exam	Final Exam	45
Midterm Test	Midterm Exam	35
Homework	Homework	20
Total		100

Workload Breakdown

Type	Description	Hours
Lecture	Regular Lectures	34
Assignment	Homework Solution Preparation	55
Exam	Midterm Exam Preparation and Midterm Exam	18
Exam	Final Exam Preparation and Final Exam	20
Other	Pre-Lecture Preparation	10
Other	Lecture Review	40
Total		177

Sources

Reference Materials

- Linear Estimation Theory by Thomas Kailath

Required TextBooks

- Fundamentals of Statistical Signal Processing. Vol.1: Estimation Theory, by Steven M. Kay

Other

N/A

Academic Dishonesty

N/A