

# *Optimal Signalhandling, OSB, ETTN10*

*Electrical and Information Technology, Lund University.*

## **- Optimal Signal Processing 2013, Course description-**

### **Introduction**

Welcome to the course in Optimal Signal Processing. The course will be held by **Nedelko Grbic** (phone: 2229021, room E:2540).

Lectures: 14 h. Exercises: 28 h. Laboratory work: 8 h.

**Aim:** The course presents the fundamentals on statistical signal processing and treats the development of optimal methods and how these methods can be applied. The traditional approach to designing filters, usually based on specifications on "passband/stopband", is replaced by a design based on the statistical properties of the signal and the noise.

**Description:** Discrete-time signals, matrix representation, eigenvalues and eigenvectors, stochastic processes, correlation matrix, signal modeling e.g. by Prony's method, stochastic models (AR and MA), normal equation, Levinson recursion, lattice filters, forward and backward prediction, Wiener filtering (FIR and IIR structures), spectrum estimation - non-parametric and parametric methods, frequency estimation (MUSIC).

### **Litterature**

- Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley, 1996.  
ISBN: 978 047 159 431 8  
ISBN: 978 047 159 431 4 (paperback)
- Extra material which can be downloaded from the homepage.

### **Information during the course**

Information is found at the homepage <http://www.eit.lth.se/kurs/ettn10>

### **Lectures and exercises**

Lectures: Nedelko Grbic (room E:2540, [nedelko.grbic@eit.lth.se](mailto:nedelko.grbic@eit.lth.se)).

Lectures: Monday 15.15-17.00, room E:1406.

Exercises: Wednesday 13.15-15.00, room E:1147, Thursday 08.15-10.00, room E:2311.

### **Laboratory work**

Laboratory work is compulsory. Please sign up for date and time on the homepage on September 16 2013.

Information: Birgitta Holmgren, tel. 2229020, [bh@eit.lth.se](mailto:bh@eit.lth.se).

### **Computer exercises**

Two exercises use computers, and will be in room E:4115/16. Please download the manual for this from the homepage in advance.

## Schedule for the lectures

Mondays 15.15-17.00, room E:1406.

- F1 Chapter 1,2,3. What is optimal signal processing , Models, Applications
- F2 Chapter 4. Signal modeling
- F3 Chapter 5. Levinson-Durbins recursion
- F4 Chapter 6. Lattice filter
- F5 Chapter 7. Optimal filters - Wienerfilter, prediction, Kalman filters
- F6 Chapter 8. Spectral analysis
- F7 Chapter 8. Spectral analysis

## Schedule for the exercises

- V1 2.5, 2.14, 2.16, 3.1, 3.3, 3.5abc, 3.6b, 3.8ab, 3.10, 3.15a-e, 3.17, 3.25, 3.26
- V2 4.2, 4.6, 4.10, 4.18, 4.19, (4.21, 4.11)
- V3 4.24, 5.1, 5.6, 5.12ab, 5.17, 5.20ab, (5.10)
- V4 5.22, 6.1, 6.3, 6.8, 6.10a (6.4ab)
- V5 7.1, 7.2, 7.7, 7.10, 7.12, 7.15
- V6 7.4, 7.5, 8.3, 8.5 8.7, 8.13ab,
- V7 8.22ab, 8.28a+partly b, problems from old exams

## Examination

The examination consists of a written exam. The written exam consists of 5 problems. Each problem will give maximum 1 mark.

**Limits 0-1.9 not passed, 2.0-2.9 gives grade 3, 3.0-3.9 gives grade 4, 4.0-5.0 gives grade 5.**

- **The date for the final exam is October 25, 14.00-19.00, 2013 at Kår:Gasq.**
- **You may use the textbook during the exam.**

To pass the course, you must pass the final exam and fulfill the laboratory works.