



## ESTIMATION ET TRANSMISSION DE L'INFORMATION

### OPTIMAL FILTERING AND INFORMATION TRANSMISSION

Lecturers: Eric BLANCO, Julien HULLERY, Laurent BAKO

| Lecturers : 12.0 | TC : 18.0 | PW : 4.0 | Autonomy : 14.0 | Study : 0.0 | Project : 0.0 | Language : FR

#### Objectives

The growth of communication and information processing systems has led to the emergence of new services. This development is based on an ever greater appropriation by the industrial world of information theory and signal processing methods whose theoretical bases have been presented in the first year course STI tc2. The objective of the course is to complete the presentation of the basics and methods of signal processing in order to acquire a complete set of tools to address the modeling, analysis and filtering of signals, as well as the operation of communication channels. These principles are found in applications such as telecommunications, software sensors or GPS positioning.

**Keywords :** Stochastic signals, Generator system, Wiener filter, Kalman filter, Information theory, Source entropy, Channel capacity, Coding theorems

#### Programme

Part I: Optimal filtering

- 1- Stochastic signal
- 2- Wiener filtering
- 3- Kalman filtering

Part II: Information Transmission

- 1- Elements of information theory
- 2- Entropy and source coding
- 3- Capacity and channel coding

#### Learning outcomes

- Modelling a signal and build a generator process.
- Design an optimal filter in the time or frequency domains.
- Implementing an entropic source coding scheme.
- Calculate the limits of performance of a communication system.

#### Independent study

**Objectifs :** Implementation and evaluation of a complete system of information transmission through a channel. The work includes the realization of the coding/decoding, modulation/demodulation and channel equalization steps.

**Méthodes :** Definition of specifications, signal / system modelling, implementation under matlab/simulink, implementation of an evaluation protocol of the proposed solutions.

#### Core texts

T. Assefi, *STOCHASTIC PROCESSES AND ESTIMATION THEORY WITH APPLICATIONS*, John Wiley & Sons, 1979  
T. Cover, J. Thomas *ELEMENTS OF INFORMATION THEORY*, John Wiley & Sons, 2006  
O. Rioul *THÉORIE DE L'INFORMATION ET DU CODAGE*, Hermes Sciences, 2007

#### Assessment

Final mark = 70% knowledge + 30% know-how  
Knowledge = 80% final exam + 20% continuous assessment  
Know-how = 100% final exam (oral)