UCLouvain

lelec2880

2026

Estimation and communication theory

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Louveaux Jérôme ;Vandendorpe Luc ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Ce cours suppose acquises les notions de base en télécommunications dispensées au travers des cours LELEC1360 Télécommunications et LELEC2795 Communication systems.
Main themes	Ce cours s'inscrit dans l'offre des cours ELEC en télécommunications. Il se focalise sur les questions d'estimation, de synchronisation, de détection et de localisation.
Learning outcomes	**At the end of this learning unit, the student is able to :** • AA1.1, AA1.2, AA1.3 • AA2.1, AA2.2, AA2.4 ; AA2.5 • AA3.1 ; AA3.2 • AA4.2, AA4.4 • AA5.2 ; AA5.3, AA5.6 At the end of this course, students will be able to : • calculate the probability of error affecting a non-coherent demodulation of a digital transmission disturbed by additive white Gaussian noise, as a function of the decision rule used; • orally present the results of a project carried out by groups (of 2 students), consisting in the analysis of a transmission system; • express mathematically and simulate in Pyhton, using the complex envelope formalism, the signal at all points of a simple digital communication chain, as well as the various operations applied to it (filtering, modulation, coding, decoding, etc.); • derive and characterize estimation algorithms; • derive simple synchronization methods based on maximum likelihood, and evaluate their performance; • calculate digital source entropy and channel capacity in the Shannon sense; • derive algorithms for tracking problems.
Evaluation methods	The project is evaluated through a written report and an oral session including presentation and discussion of the results. This evaluation accounts to 1/3 of the final mark. It can not be performed in second session. The mark from the first session is kept in second session. The students are evaluated individually through a written exam focusing on understanding, explanation and usage of concepts seen during the courses (but not based on restitution of content). This exam accounts for 2/3 of the final mark.
Teaching methods	The course is organized in • 12 lectures • 6-7 exercie sessions • A simulation project, made in groups of 2 students and covering the equivalent of 6-7 exercice sessions.
Content	• Continuous-phase frequency modulation and noncoherent demodulation • Channel capacity, and capacity region for a multiple access channel • Estimation • Synchronization • Tracking methods • Geoloalization • Coding gain, turbo-codes, turbo-equalization and turbo-synchronization
Inline resources	Moodle http://moodleucl.uclouvain.be/course/view.php?id=4823
Bibliography	• Slides du cours • Syllabus • Enoncés des séances et du projet L'ensemble de ces supports sont disponibles sur Moodle

Faculty or entity in charge	ELEC

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Electrical Engineering	ELEC2M	5		🔍
Master [120] in Mathematical Engineering	MAP2M	5		🔍