UCL Université catholique de Louvain

LELEC2880

2010-2011

Modem design

5.0 credits	30.0 h + 30.0 h	2q

Teacher(s) :	Louveaux Jérôme ; Vandendorpe Luc ;
Language :	Français
Place of the course	Louvain-la-Neuve
Main themes :	Identical to the contents of the course
Aims :	At the end of this lecture, the students will be able to - use and understand, for a signal correpted by additive white noise gaussian, the link between the signal, its analytical version, its complex envelope and the Rice components, - use MATLAB to implement a filter in the previous formalism, - expand a digitally modulated signal onto basis functions, - derive the decision rule of an optimal receiver according to the Bayes criterion, for a digital modulation, - establish and compute the bit error rate characterizing the coherent or noncoherent demodulation of a digital transmission corrupted by AWGN, - explain "a priory" and "a posteriory" entropy, - compute the entropy of a source and the Shannon channel capacity, - from the maximum likelihood criterion, derive a Viterby equalizer, - for a Wiener criterion, derive the equations to be fulfilled by a linear or decision feedback equalizer, and solve these equations, - show the relevance of the matched filter by means of a fractionally spaced equalizer and apply this result to other systems, - implement in MATLAB, Viterbi, linear and DF equalizers, - explain from the ML criterion DA or NDA type phase estimators, and understand the tools to characterize the performance of these estimators, - explain from the ML criterion, estimators for the sampling instant (timing recovery) of the DA and NDA types and explain their performance, - understand and provide a mathematical description of multicarrier modulations, cyclic extension and explain the motivation for MC modulation. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled “Programmes/courses offering this Teaching Unit”.*
Content :	- Gaussian random signals - Baseband representation for signals and systems - Digital modulations with and without memory - Modulation and demodulation in an AWGN channel, optimum receivers - Information theory : entropy and Shannon capacity - Detection : Viterbi equalization, linear and decision-feedback equalization, fractionally spaced equalization - Synchronization : phase estimation (DA and NDA); timing recovery (DA and NDA) - Multicarrier modulations : motivation, implementation with the (I) FFT, cyclic extension, need for coding
Other infos :	Teaching and learning method Lectures interleaved with practical training possibly in computer room with MATLAB. A project about the performance computation of equalizers and/or synchronizers is proposed either. Prerequisits Telecommunications I (ELEC2360) and Telecommunications II (ELEC2795). Assessment Written examination based on exercices, with personal and lecture notes along with the evaluation of the project based on report, and oral discussion about obtained results.
Cycle and year of study :	> Master [120] in Electrical Engineering > Master [120] in Mathematical Engineering > Master [120] in Electro-mechanical Engineering
Faculty or entity in charge:	ELEC