

Télécommunications

Digital coding and modulation

AIMS

Give an overview of the coding techniques from information theory including source and channel coding.

Present the main modulation technics used for digital signal transmission

This EC is part of the teaching unit Communication Systems [TC-3-S1-SCM] and contributes to the following skills:

C5 Implement, implement, develop, deploy systems for transmission and processing of signals / images / data

Capacity: Manipulate numeric codes

Capacity: Implement source / channel coders

Knowledge: Information Coding, Boolean Algebra, Combinatory Logic, and Sequential Logic

Knowledge: Source Coding: Source Coding Theorem, Shannon-Fano Coding, Huffman Coding, Arithmetic Coding, RLC Coding, and LZW Coding

Knowledge: Channel coding: Channel coding theorem, Hamming codes, Cyclic codes [BCH], convolutional codes.

C8 Operate, analyze, improve digital systems

Capacity: Evaluating the performance of a digital modulation

Capacity: Analyze the structure of a digital modulator.

Knowledge: Principle of numerical modulations, evaluation criteria

Knowledge: Modulation of digital signals: by amplitude displacement [MDA], phase [MDP] and frequency [MDF] and QAM modulation.

Knowledge: Structure of modulators and demodulators.

C1 Specify, design and model transmission and signal / image / data processing systems

Capacity: Sizing and Evaluating Encoders [Source / Channel]

Capacity: Conduct functional modeling and analysis of a digital transmission system

Knowledge: Source Encoding, Channel Encoding

Knowledge: Modulation of digital signals: by amplitude displacement [MDA], phase [MDP] and frequency [MDF] and QAM modulation.

In addition, it requires the following skills:

A4 Design a system that meets a set of specifications

A2 Exploit a model of a real or virtual system

B2 Work, learn, evolve autonomously

B3 Interact with others, work in a team

CONTENT

Knowledge to be acquired:

- Source / Channel and Entropy / Capacity

- Source coding: Source coding theorem, Shannon-Fano encoding, Huffman encoding, Arithmetic encoding, RLC encoding and LZW encoding

- Channel coding: Theorem of the channel coding, group codes [Hamming], cyclic codes [BCH], convolutional codes.

- Principle of numerical modulations, evaluation criteria [probability of error, spectral occupation, inter-symbol interference, eye diagram, constellation].

- Modulation of digital signals: amplitude [ASK], phase [PSK] and frequency [FSK] and QAM modulation.

- Structure of modulators and demodulators.

BIBLIOGRAPHY

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IDENTIFICATION	
CODE :	TC-3-S2-EC-DCO
ECTS :	2.0

HOURS	
Lectures :	4.0 h
Seminars :	24.0 h
Laboratory :	4.0 h
Project :	0.0 h
Teacher-student contact :	32.0 h
Personal work :	30.0 h
Total :	62.0 h

ASSESSMENT METHOD	
2h exam. Continuous evaluation through active participation	

TEACHING AIDS

TEACHING LANGUAGE

French

CONTACT

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- [2] A. Spataru, \ "Fondements de la théorie de la transmission de l'information\ ", Ed : Presse Polytechnique Romande, Lausanne, 1987, 625 p.
- [3] T.M. Cover, J.A. Thomas, \ "Information theory\ ", Ed : Wiley Interscience, New York, 1991, 542 p.
- [4] G. Brassard, \ "Cryptologie contemporaine\ ", Ed: Masson, 1993, 122 p.
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- [6] P.Lecoy, \ "Technologies des télécoms\ ", Ed.: Hermes, 1995, 373 p.
- [7] Ph. Fraisse et al, \ "Transmission de l'information\ ", Ed. Ellipses, 1999, 191 p

PRE-REQUISITE

Basis of engineering science

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