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Politecnico di Torino

Academic Year 2009/10 (first time established in A.Y.2007/08)

01KSBJA

Photonic transmission systems

1st degree and Bachelor-level of the Bologna process in Electronic And Computer Engineering - Vercelli (III FACOLTA' DI INGEGNERIA)

Teacher	Status	SSD	Les	Ex	Lab	Years Stability

SSD	CFU	Activities	Area context
ING-INF/03	5	D - A scelta dello studente	A scelta dello studente

Objectives of the course

This course provides, as an introduction, a full review of an optical fiber network transmission level, i.e. networks largely employed in modern telecommunications systems. After a full rewiew on optical devices and on link types used, the course allows students to develop some simplified projects of the diffrent type of networks taken in exam.
Limitations due to the transmissive medium losses, as well as the chromathic dispersion and other non-linear effects, will be discussed.
Eventually, a full review on optical transmission protocols (SONET/SDH, GIgabit Ethernet, etc..)
will be given in order to understand the limitations they impose on the physical layer.

Expected skills

o Optical network devices
o Different network link types
o Simplified project of different network link types
o Dispersion equalizers
o Non-linear effects: impact on system performances
o Physical layer limitations imposed by the main standards protocols used in optical communications

Prerequisites

Signal Theory
Digital Communications

Syllabus

Introduction to optical communications
o Prociples of propagation in optical fibers
o Optical fiber modes
o Single mode fibers and multimode fibers
o Modulation in optical communications
o Multiplexing techniques
o Optical transmitter
o Optical receiver
o Passive optical devices
o Optical sources
o Modulators
o Photodetectors
o Optical amplifiers
o Tutorials on optical wavelengths and optical powers
o Advanced optical components
o The structure of the transmitted signal
o Receiver sensitivity
o BER evaluation for non-optically amplified systems
o Maximum transmission distance
o BER evaluation examples
o BER evaluation for single-haul optically amplified systems
o OSNR introduction

o The sub-optimal case for non-matched filter
o Examples on BER calculation for single-haul optically-amplified systems
o BER evaluation for optically-amplified chain systems
o Q-factor
o BER evaluation examples for optically-amplified chain systems
o Chromatic dispersion in singl e-mode fibers
o BER evaluation examples for optically-amplified chain systems
o Reducing chromatic dispersion
o Pratical techniques to reduce chromatic dispersion
o Chromatic dispersion limitations: examples
o PMD

o PMD
o Kerr effect
o XPM
o Review exercises
o Optical fiber communication protocols
o SDH protocol
o Gigabit Ethernet protocol

Laboratories and/or exercises

o Theory is framed with numerical exercises in order to give a self-containing explanation of the course issues. Professor will propose some exercises to students, giving them an ammount of time to solve them, then a full commented correction will be given.
o No hours will be dedicated to experimental measurements. Students may visit "PhotonLab" laboratory in Tourin Politecnico if interested.

Bibliography

o Course slides presented during lessons (good and exhaustive coverage for the course).

Revisions / Exam

Students are asked to solve three exercises (needed) and to answer to two/three theorical questions (optional).
Answers to such questions will be positively remarked only if exercises are developed correctly.
An optional oral examination can be performed whenever the test is passed with at least 15/30.

Programma definitivo per l'A.A.2009/10

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