
Communication Systems Laboratory

Finalità

1st module (3 CFU)

The main objective of the course is to introduce the students to the measurements in telecommunications, with a particular emphasis on optical components and systems. Lessons will be alternated with experiments, so that the students can learn how to use the instruments and to apply the measurement techniques usually considered in laboratory activity.

2nd module (2 CFU) - Wireless Networks Laboratory

Introduction to the simulation and experimentation of wireless networks.

Programma

1st module (3 CFU)

Description of the characteristics and of the operating principle of the optical instruments:

- optical spectrum analyzer;
- tunable laser;
- white light source;
- power meter;
- photodiode;
- optical components (variable attenuator, isolator, coupler, ecc.);
- LabView interface and GPIB bus for data collection and analysis.

Measurement of the attenuation spectrum of optical fibers with different refractive index profile and cross-section geometry:

- single-mode fiber (SMF);
- erbium-doped and ytterbium-doped fiber.

Measurement of the bending properties of a depressed-cladding fiber:

- attenuation spectrum for different bending radius;
- bending loss for different bending radius.

Experimental characterization of a laser for telecommunications:

- power-current curve;
- threshold current;
- influence of the temperature on the laser properties.

Experimental characterization of erbium-doped fiber amplifiers:

- amplified spontaneous emission (ASE) spectrum obtained with different pump power values;
- signal gain as a function of the signal power and of the pump power;
- saturation characteristic.

Characterization of an erbium-doped fiber laser (EDFL).

Measurements regarding fiber Bragg gratings (FBG):

- spectral characterization: influence of temperature and strain;
- description and use of the interrogation system;
- FBG applications as filters, and as temperature or strain sensors.

Measurement of the non-linear effect of four-wave mixing (FWM) in dispersion-shifted fibers (DSF):

- zero-dispersion measurement in dispersion-shifted fibers (DSF) with FWM-based techniques.

Transmission measurements in WDM systems.

2nd module (2 CFU) - Wireless Networks Laboratory

Study and use of Opnet simulator, with applications to wireless networks. Programming and use of experimental Zigbee sensor network test-beds.

Attività d'esercitazione

2nd module (2 CFU) - Wireless Networks Laboratory

Computer exercises.

Modalità d'esame

1st module (3 CFU)

Oral examination.

2nd module (2 CFU) - Wireless Networks Laboratory

Written and, possibly, integrated by a project.

Propedeuticità

1st module (3 CFU)

Componenti fotonici A, Comunicazioni ottiche A, Componenti fotonici B (Photonic components A, Optical communications A, Photonic components B).

2nd module (2 CFU) - Wireless Networks Laboratory

Basic courses on telecommunication networks.

Testi consigliati

1st module (3 CFU)

Dennis Derickson, "Fiber Optic. Test and Measurement", Prentice Hall.

2nd module (2 CFU) - Wireless Networks Laboratory

To be defined.