UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Applied Electronics

2324-1-F1701Q116

Aims

Design criteria with feedback amplifiers with (stability and noise). Introduction to the use of transistors in low noise circuits. Filtering criteria for the optimization of the signal to noise ratio. Applications to the readout of signals from particle detectors.

Contents

The student is given the basic instruments to be able to design analog amplifiers, also for low noise applications. An introduction is given to the transistors operation in low noise circuits. Filtering for optimization of signal to noise ratio. Understanding of signal acquisition criteria from particle detectors for astroparticle physics and with accelerators.
The lecturers are for students in physic that are particularly interested in the experimental field.

Detailed program

The concept of amplifier, the Operational amplifier. The concept of feedback of an amplifier. The mathematical approach t to the determination of all the aspects that concern a fed backed amplifier. The frequency domain analysis of the signals with Fourier and Laplace Transforms. The stability of a feed backed network and the compensation criteria. The noise in the electronic systems and the analysis of the noise in linear networks. The concept of the signal t to noise ratio. The charge sensitive preamplifier and the shaping of the signals coming from a nuclear detector of particles.

A short introduction to the physic of semiconductors applied to Bipolar, JFET and MOS transistors. The mathematical modelling and the noise sources in transistors. Transistors in low noise circuits. Circuit solutions for

charge sensitive preamplifiers. A study is given on the basic blocks of Operational Amplifiers: input stage, intermediate stage, output stage and the more common electrical protections.

Investigation of the behaviour of electronics devices at extremely low temperatures, cryogenic temperatures, and in radioactive environments in the contest of experiments about neutrino physics and dark matter and the physics with accelerators.

Prerequisites

Notions on classical Physics: Electricity and Magnetism

Teaching form

- Lectures, tutorials, circuit simulation examples using MATLAB Symbolic, MATLAB Simscape-Electronics and PSPICE, 6 cfu, 42 hrs.
- Lecture recordings will also be available for use on this web platform , subject to course registration and classroom attendance.

Textbook and teaching resource

- Projected course handouts will be available at the same time as the lectures on this web page by clicking on enter in the upper right corner.
- Reference texts will be indicated in the handouts and also on the course web page.

Semester

First Semester

Assessment method

The examination will be conducted with a single final interview on all topics covered.
NOTE: Next to each lecture notes you will find indications of any topics left for further study that will not be discussed. The lectur notes are intended to be considered the basis of the required topics.

Office hours

Anytime, upon notice: pessina@mib.infn.it

Sustainable Development Goals

QUALITY EDUCATION