ENEE322: Signal and System Theory

Credits: 3

Description

Prerequisite: Minimum grade of C- in MATH246; and minimum grade of C- in ENEE222; and permission of ENGR-Electrical & Computer Engineering department.

Restriction: Must be in one of the following programs (Engineering: Computer; Engineering: Electrical).

Concept of linear systems, state space equations for continuous systems, time and frequency domain analysis of signals and linear systems. Fourier, Laplace and Z transforms. Application of theory to problems in electrical engineering.

Semesters Offered

Fall 2017, Spring 2018, Summer 2018, Fall 2018, Spring 2019, Summer 2019, Fall 2019, Spring 2020, Summer 2020, Fall 2020, Spring 2021

Testudo

Learning Objectives

- To understand harmonic analysis of periodic and aperiodic signals, their frequency composition and the importance of filters in system design
- To develop the ability to predict and analyze the response of linear systems to various types of input signals in both quantitative and qualitative terms
- To develop the ability to use transforms as the mathematical toolbox for the analysis of signals and systems, to be able to determine which of the transforms applies to the analysis of a given discrete-time or continuous-time system, and to be able to calculate direct and inverse transforms of simple signals

Topics Covered

- Signals, their properties and representation. Periodic signals. Unit impulse and unit step signals
- Linear systems and their properties. Causality, stability, time-invariance, invertibility
- Representation of systems by block diagrams, differential or difference equations
- Fourier series representation of periodic signals. Energy and power signals, distribution of energy over the spectrum of the signal. Discrete-time Fourier series and their use for the harmonic analysis of discrete signals
- Development of the Fourier transform as a limiting case of Fourier series of periodic signals with increasing period. Continuous and discrete-time Fourier transforms

- The use of Fourier transforms for the analysis of linear systems represented by block diagrams and differential equations
- The continuous-time Laplace transform, its properties and its relation to the Fourier transform
- The use of the Laplace transform for the analysis of linear systems. Bode plots as a tool for the analysis of first- and second-order systems
- The z-transform and its use for the analysis of linear-time systems