

Modeling and Simulation

Overview

This course introduces students to the principles and techniques of modeling and simulation in the field of electrical and electronics engineering. The course emphasizes hands-on experience with Python and its related scientific libraries.

Learning Outcomes

By the end of the course, students will:

Understand the importance of modeling and simulation in electrical and electronics engineering, Use Python and its scientific libraries to implement mathematical models and simulations, Solve differential equations and apply Laplace transforms using Python, Build and simulate time-continuous systems using Python, Apply these skills to analyze real-world case studies and complete a final project.

Content

Introduction to Modeling and Simulation:

- Different types of models: mathematical, physical, computational.

Mathematical Modeling:

- Techniques for building mathematical models, with an emphasis on the establishment of differential equations.
- The application of mathematical models in the context of electronics and mechanics.
- Exploring the analogy considerations between different physical systems.

Laplace Transforms:

- Utilizing Laplace transforms as a solution method for differential equations.
- In-depth understanding of transfer functions, poles, and zeros, limit value sets.

Simulation of Time-Continuous Systems:

- Analyzing and visualizing the behavior of time-continuous systems through simulations.

Case Studies and Laboratory Exercises:

- Hands-on exercises that allow students to apply their knowledge in a practical context.

Project Work:

- A final project work that incorporates all the concepts taught in the course, encouraging students to build, simulate, and analyze a system of their own.

Assessment

- Participation in online discussions and exercises (20%)
- Final Project (80%)

Resources

- Python Documentation: <https://docs.python.org/3/>
- NumPy Documentation: <https://numpy.org/doc/>
- SciPy Documentation: <https://docs.scipy.org/doc/>
- Matplotlib Documentation: <https://matplotlib.org/contents.html>
- Lecture Notes in Github: https://github.com/yazicienis/Modeling_Simulation_Lecture_Notes