COURSE DETAIL

MATHEMATICAL MODELING

Country
Netherlands

Host Institution
Maastricht University – University College Maastricht

Program(s)
University College Maastricht

UCEAP Course Level
Upper Division

UCEAP Subject Area(s)
Mathematics

UCEAP Course Number
102

UCEAP Course Suffix

UCEAP Official Title
MATHEMATICAL MODELING

UCEAP Transcript Title
MATHEMATICAL MODEL

UCEAP Quarter Units
6.00

UCEAP Semester Units
4.00

Course Description

Full course description

To describe natural phenomena and processes, mathematical models are widely used. The focus in this course shall be on dynamical models (i.e., where time plays a role) in particular those that have interaction with the environment through inputs and outputs. Mathematical systems theory provides the framework to deal with such models in a systematic and useful way. First we consider some general aspects of mathematical modeling. Then we briefly address dynamical systems without inputs and outputs - but which may show nonlinear behavior. We study basic properties such as equilibrium points, linearization, and stability. We then switch to linear dynamical models with inputs and outputs. They are used in many different areas of the natural sciences and in engineering disciplines. We discuss the following topics and concepts. Linear difference and differential equations, Laplace transforms, transfer functions of linear systems; controllability, observability, minimality; system representations with an emphasis on state-space representations and canonical forms; stability; the interconnection of linear systems including feedback; frequency domain analysis and the relationship with filter theory, Fourier analysis, and time series analysis. To demonstrate the applicability of the techniques and concepts, many examples from science and engineering are mentioned and briefly discussed.

Course objectives

- To have the ability to interpret dynamical phenomena as mathematical systems and to cast them into such form.
- To understand the basic concepts of linear systems theory.
- To be familiar with analysis techniques for linear systems, to understand their behavior and interaction.
- To become familiar with some application areas of mathematical systems and models.

Prerequisites

SCI2019 Linear Algebra and SCI2018 Calculus

Language(s) of Instruction
English

Host Institution Course Number
SCI3006

Host Institution Course Title
MATHEMATICAL MODELING

Host Institution Course Details
https://www.maastrichtuniversity.nl/education/bachelor/university-college-maast...

Host Institution Campus
University College Maastricht

Host Institution Faculty

Host Institution Degree

Host Institution Department
Sciences

Course Last Reviewed
2022-2023

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