Distributed Parameter Systems

lecturers

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objective

Modeling of dynamical systems with a spatial component leads to lumped parameter systems, when the spatial component may be denied, and to distributed parameter systems otherwise. The mathematical model of distributed parameter systems will be a partial differential equation. Examples of dynamical systems with a spatial component are, among others, temperature distribution of metal slabs or plates, and the vibration of aircraft wings.

This course provides an introduction to linear distributed parameter systems. We will study the state space formulation of these systems. Special attention will be paid to the class of port-Hamiltonian systems in which the norm of the state is given by the energy (Hamiltonian) of the system. This fact enables us to show relatively easy the existence and stability of solutions. Further, it is possible to determine which boundary variables are suitable as inputs and outputs, and how the system can be stabilized via the boundary. For the stabilization we look at static, dynamic and non-linear dynamic controllers.
At the end of the course the students should be able to model distributed parameter systems as distributed parameter system, and should be able to apply known concepts from system and control theory like stability, stabilizability and transfer functions to these systems.

contents

1. Distributed parameter system and its mathematical formulation.
2. Mathematical background.
3. Existence of unique solutions.
4. Control/observation at the boundary
5. Transfer functions
6. Stability and stabilizability.
7. Semi-linear systems
8. Dynamic boundary stabilization.

prerequisites

Basic undergraduate courses in systems and control

lecture notes

Lecture notes are under preparation and will be distributed during the presentations of the course.

homework assignments

Four homework assignments will be given during the course lectures. The assignments will be graded and the average grade will be the final grade for the course.