nonlinear control systems

lecturers

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objective

The course aims at introducing methods for the analysis and control of nonlinear systems, including fundamental results on stability and dissipativity, geometric control theory as well as a set of self-contained results on the control design of nonlinear systems.

contents

Stability and dissipativity of nonlinear control systems
Lecture 1 Introduction to nonlinear systems, nonlinear differential equations, Lyapunov stability theory, LaSalle's invariance principle
Lecture 2 Dissipativity theory, passivity, L_2 gain stability, input-to-state stability
Lecture 3 Interconnected systems, passivity theorem, small-gain theorem, circle criterion

Analysis of nonlinear control systems
Lecture 4 Introduction to nonlinear control systems and fundamentals of geometric control theory
Lecture 5 Feedback linearization (relative degree, zero dynamics)
Lecture 6 (High-gain) Observer design

Nonlinear control design
Lecture 7 Control Lyapunov functions and backstepping
Lecture 8 Nonlinear output regulation theory and internal model principle

course materials

The lecture notes will be distributed during the course.

prerequisites

The students are expected to be familiar with linear control systems, functional analysis and algebraic topology.

homework assignments

There are four homework assignments (once every two lectures) that will be distributed during the lectures. Each assignment must be handed in within two weeks.