Space State

Component
École Nationale Supérieure d'Électrotechnique d'Électronique d'Informatique d'Hydraulique et des Télécommunications

In brief

- **Ametys Code:** N8AE14A
- **Open to exchange students:** No

Presentation

Objectives

1) Model continuous-time and discrete-time dynamic systems in state space,

2) Analyze the dynamic behavior of these systems based on their modeling in state space (poles, zeros, stability, controllability, observability, transfer functions, time response),

3) Synthesize state-feedback control architectures, and state-feedback with integral action in continuous time,

4) Synthesize integer-order and reduced-order observers,

Description

Using control architectures based on low-order linear controllers of type P, PI, or PID allows for the control of a certain class of systems with very good performance, but how can this be done if the open-loop system is already of order 4, 5, ..., 10, ..., 100, ..., as is the case for a large majority of the systems around us and in industry (electrical systems such as converters, electric actuators, or networks); but also renewable energy production systems, vehicles, robots, production lines, heating systems, economic systems, etc. The controllers mentioned earlier are effective over a specific frequency range but have limited effectiveness when it comes to controlling the dynamic behavior of a high-order system, especially when its poles are spread across the frequency spectrum. This course introduces a modeling formalism called "state-space" modeling, which allows for the analysis and synthesis of appropriate control laws for such systems, regardless of their order, which we encounter daily.

Pre-requisites

Synthesis of controllers and control architectures

Sampled systems

Algebra and matrix operations (matrix multiplication, eigenvalues and eigenvectors, determinant, matrix inversion, diagonalization)

Laplace transform, Integral calculus