sampled linear systems

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

Semester
Printemps

In brief

- **Ametys Code:** N8AE05B
- **Open to exchange students:** No

Presentation

Objectives

Be able to...• Identify the different components and the role of the sampling period,• Construct the equivalent continuous block diagram of a discrete control system,• Calculate the parameters of a continuous controller and discretize it,• Define the block diagram in z,• Calculate the transfer functions in z and the associated time responses,• Calculate the poles and deduce the type of associated time response,• Calculate a PID controller in z and deduce its recursive equation, and vice versa.

Description

Presentation of a sampled speed control: block diagram, functions implemented in a digital controller. Influence of the sampling period: influence of the sampling period on stability, destabilizing effect of Sampling/Hold. Study of control by approximation to a continuous system: definition of the equivalent continuous system, methods for studying sampled controls, synthesis of P controller, discretization of continuous controller. Z-transform: definition and properties, discrete transfer functions, real poles - complex poles. Time-domain study of sampled control systems: static study: accuracy, dynamic study: stability, time responses.

Synthesis of sampled controllers, Experimental tuning of sampled controllers
Criteria for choosing the sampling period: Shannon criterion, real poles, complex poles, phase shift due to sampling/blocking, processing time on the computer, problem of derivation, influence of noise, number coding on microprocessor.

Pre-requisites

• Decomposition into Fourier series,
• Plotting Bode, Black, and Nyquist diagrams, calculations of continuous linear controllers, nested loops, and feedforward chains,
• Basic calculations with the Z-transform, signal transform, inverse transform, final value theorem, initial value theorem, delay…
• Calculations with complex numbers, solving first- and second-order differential equations.