Digital control

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

In brief

- **Ametys Code:** N8EE14A
- **Open to exchange students:** Yes

Presentation

Objectives

The main objective is to understand the various issues encountered when digitally controlling a real-time system under severe time constraints.

The first chapter will be devoted to a general introduction to digital control and the concepts of open-loop and closed-loop systems. Details of an architecture dedicated to real-time digital control will then be presented.

The second chapter will focus on the concept of sensors (accuracy, bandwidth, linearity, etc.) and on the various analogue-to-digital and digital-to-analogue conversion technologies (single and dual ramp, successive approximation, flash, pipeline, etc.).

The third chapter will be a comparative study of the different modes of process control, in particular polling mode and interrupt mode. The advantages and disadvantages of each will then be examined.

The fourth and final chapter will be devoted to the study of the evolution of microprocessor architectures with a view to increasing performance. The following architectures will then be described: RISC/CISC, execution pipeline, superscalar, VLIW, Harvard, memory cache, introduction to multiprocessing.

Description

The digital control of a real-time system places very heavy constraints on the digital architecture used, which must therefore be very different from the architectures traditionally used on a PC. These constraints will therefore be analysed and translated into requirements for the digital architecture.

Digital system control also highlights the central importance of sensors in determining the status of the system to be controlled. We will therefore propose, on the one hand, a study of the main properties and defects of sensors and, on the other hand, a study of analogue-to-digital and digital-to-analogue conversion systems.

Performance requirements (digital calculation, rapid sampling) in the context of digital control will lead us to study the latest advances in microprocessor architecture with a view to increasing performance.

Pre-requisites

N5EE03-Logic System Design

N5EE02- Basic Elements of Algorithms, Programming and Computer Architecture

N7EE01- Computer System Architecture and Development