2EL5080 – Robust electronic and embedded systems

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Department: CAMPUS DE METZ
Language of instruction: FRANCAIS
Campus: CAMPUS DE METZ
Workload (HEE): 60
On-site hours (HPE): 35,00
Elective Category : Fundamental Sciences
Advanced level : Yes

Description

Many electronic systems are called embedded because they are part of a larger whole by interacting with the world around them. The use of such systems is so widespread that the fields of application are very varied and the economic stakes are significant. These systems require, for their operations, to study the interactions with their environment, not only because of their function, but also because they can be disturbed by external influences. It is therefore essential to consider supply and autonomy issues (for battery operation for example), temperature, size, reliability or component lifespan. These issues are to be managed both in terms of hardware design and software design.

In addition, electronic disturbances have become an important issue, so that regulations require marketing approval.

This course will mainly focus on two points:

   • programming microcontrollers for an application that must interact with its environment in real time,

   • the resistance of systems to electromagnetic disturbances according to regulation: not being destroyed by unexpected powerful events, and functioning normally in the presence of usual disturbing events.

Quarter number

SG8

Prerequisites (in terms of CS courses)

Signal processing course of the ST4 (1C4000). Having followed the 1st year elective course of Electronic Systems (1EL8000) can be a plus.

Syllabus

Taking the example of a data acquisition system, this course addresses the following concepts:

   • Issues, economic context, regulation
   • Theoretical aspects of signal acquisition and reconstruction, Shannon

and Nyquist theorems, out-of-band acquisition, I / Q acquisition
   • Analog electronics for acquisition processing (amplifiers, multiplexers, filters, converters)
   • Basic digital processing and associated components; programming for real-time processing
   • Fragility of the components and solutions considered
   • Disturbances and proposed solutions

Class components (lecture, labs, etc.)

18h of lecture, 15h of tutorials, 2h of exam in case of a presentation (see : méthodes d'évaluation).

Grading

Depending on the number of students registred in this course, the evaluation wil consist in:
- An individual presentation addressing the themes of this course for a particular component (if it is possible to organize the session)
- An individual report addressing the themes of this course for a particular component (if there are too many students to organize the session). Components will be proposed by the teacher, but students may choose other components than those proposed (the approval of the teacher will be required). The same component can only be presented by one student.

In case of insufficient initial examination, a remedial examination will be proposed which will take the form of an individual report to be drawn up (therefore the second form envisaged above for the initial examination).

Course support, bibliography

« Fonctions, composants et perturbations », Jean-Louis Gutzwiller, Handout.

Resources
Lectures will be given to present the main concepts.
Applications will be tested on electronic cards during tutorial courses.

Tutorial groups size : 24 students

Learning outcomes covered on the course
• To know the disturbance mechanisms that can interfere with the operation of embedded systems

• To know the classical solutions used to limit the effects of disturbances
• To choose between these different solutions to solve a given case
• To design embedded systems to be resistant to disturbances
• To specify a system with the people in charge of the design of the electronic cards

Description of the skills acquired at the end of the course
C1 : Analyze, design, and build complex systems with scientific, technological, human, and economic components
C2 : Develop in-depth skills in an engineering field and a family of professions
C7 : Know how to convince