



---

## 2EL5090 – Design of complex electronic systems: from component to heterogeneous system

---

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

---

### Description

For a decade, French electronics has invested in high value-added areas and advanced sectors such as aeronautics, defense, medical, smart card payment, fiber optic telecommunications ..., discarding consumer products such as televisions and telephones.

Electronic systems cover a wide range of applications, ranging from analog electronics, with the amplifier as a basic function, to digital electronics, which implements the "smart" part of systems. In addition, the frequency range extends over a very broad spectrum ranging from low frequency applications such as audio processing to very high frequency applications such as radio communications.

The very different constraints related to this wide variety of themes impose different design tools that are adapted to each problem.

This course will provide students with basic concepts and knowledge of the tools used to design both analog and digital electronic systems.

### Quarter number

SG6

### Prerequisites (in terms of CS courses)

Automatic course of ST5. Having followed the 1st year elective course of Electronic Systems (1EL8000) can be a plus.

### Syllabus

The course will present the components and methods of synthesis using the different tools (and understanding their limits) in order to give the future engineers the means to take part in the design of heterogeneous electronic systems.



### **Class components (lecture, labs, etc.)**

Teaching will be given in the form of directed courses with presentations of concepts, application exercises and practical work.

### **Grading**

A written report will be requested on Laboratory Work. The final written exam will count for 70% of the final grade. The Laboratory Work report will count for 30% of the final grade. The catch-up session will be in the form of an oral examination.

An unjustified absence in Laboratory Work will be penalized with a 0 for the session.

### **Course support, bibliography**

- Documentations of components available on the internet.
- Modélisation des composants usuels pour la conception et l'analyse – Patrick Aldebert – 01134/01.
- Introduction à l'électronique analogique – Gilles Tourneur – 17189/01.
- Systèmes logiques et électronique associée – Volume 1 – Jacques Oksman, Jean-Philippe Szlowicz, Philippe Bénabès – 11121/01.

### **Resources**

Teacher : Yves Houzelle.

LTspice software for analog simulation.

Quartus software for numerical simulation.

Education development board for digital part.

### **Learning outcomes covered on the course**

- Know the concepts of analog and digital electronics : component modeling, polarization, linearization, large signal analysis, loopback and feedback, impedance matching, synchronous sequential logic, frequency behavior.
- Master the main tools of CAD and simulation.
- Be able to analyze electronic functions using the appropriate models.
- Know how to design and dimension electronic functions by taking into account the interfaces between components and with external interfaces.
- Know how to specify an electronic system, and write specifications.



### **Description of the skills acquired at the end of the course**

- C1 : Analyse, 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.