## Robot programming methods (at ECN)

| Credits: 4   Semester 2   Compulsory: Yes | | | |
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| **Format** | Lectures   18 h | Examples   14 h | Private study   68 h |

**Lecturers: G. Garcia (ECN)**

**Objectives:** This course gives the student the fundamentals of robot programming, both in terms of specialized robot languages and in terms of offline, simulation based, robot programming.

**Contents:**
- Analysis of the worldwide robot market (types of robots, types of applications),
- Characteristics of the main areas of application,
- The different levels of programming,
- Tools for teaching locations,
- Robots, sensors and flexibility,
- What makes robot programming different?
- Synchronous vs asynchronous moves,
- Guarded moves,
- Sensor-referenced control,
- Tool-level programming,
- Object level programming,
- Real-time aspects of robot programming,
- The V+ language, including its real-time aspects and sensor-handling capabilities,
- The main functions of an offline robot programming system,
- Cycle time computation and RRS (Realistic Robot Simulation),
- Reality vs simulation models,
- Problems encountered when downloading programs prepared in simulation.

**Practical Work:** The students will be able to practice with a setup of two Stäubli industrial robots, a Puma 560 and a RX 90 programmable in V+. The robots are equipped with a belt conveyor, and a number of sensors (vision, range). The work cell can be programmed online but will also be modelled and programmed offline under the Tecnomatix EM-engineer simulation software.

**Abilities:** After completing this course, the students will be able to:
- Analyse, program in V+ and test complex tasks on industrial robots,
- Layout workcells, program them and calculate cycle times using a professional CAD robotics system,

**Assessment:** 50% continuous assessment, 50% from end of semester examination.

**Recommended texts:**
C. Blume, W. Jakob, *Programming Languages for Industrial Robots*, Springer Verlag.
Stäubli: RX Robots Technical Documentation, 2001.

**Further readings:** will be provided by lecturer