

Advanced and Robot Programming

Credits: 5 Semester 1 Compulsory: No

Format	Lectures 16 h	Tutorials/Labs 32 h	Private study 50 h
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Lecturers: Hendry CHAME (IRCCyN) and Gaëtan GARCIA, RENATO ZACCARIA (UNIGE)

Objectives: To give the students the fundamentals of:

- C++ programming
- Industrial robot manipulator programming using specialized robot languages.

Contents:

- C++ programming
 - Functions, passing by value and by reference, constant references, pointers.
 - Static and dynamic arrays, multi-dimensional arrays, vectors, strings.
 - Classes, objects, attributes, methods, heritage, virtual methods.
 - Code organization.
 - Operator overloading.
 - Using C++ libraries.
- Industrial manipulator programming
 - The different levels of programming,
 - Tools for teaching locations,
 - Robots, sensors and flexibility,
 - Synchronous vs asynchronous motions, guarded motions,
 - Tool-level programming,
 - Object level programming,
 - Real-time aspects of robot programming,
 - The V+ language, including its real-time aspects and sensor-handling capabilities.
 - Introductory concepts about ROS

Practical Work: C++ labs are essentially oriented towards understanding and using C++ libraries and good programming practice.

As to industrial robot programming, 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.

Abilities: After completing this course, the students will be able to:

- Program in C++, especially using existing libraries like openCV.
- Analyze, program and test complex tasks on industrial robots in V+.

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

Recommended texts:

1. C. Blume, W. Jakob, *Programming Languages for Industrial Robots*, Springer Verlag.
2. Stäubli: RX Robots Technical Documentation, 2001.
3. Bruce Eckel, *Thinking in C++*, volumes 1 and 2, 2007.

Further readings: will be provide by the lecturer