

ROBOTICS ADVANCED

Background knowledge in mechanic, electric, informatics or mathematics is required.
Target group: MINT teachers and secondary school students (e.g. technical high school) with some background and a lot of interest in the field but also apprentice and re-train people who are already in daily business.

The objective is to create elite, highly educated graduates in this subject. The goal is to enable people to *understand technology* and *implement applications*.

The graduate of the **Robotics Advanced** training...

1) Masters the required basics of mathematics and physics.

- **I have knowledge in mathematics:**
 - **Linear Algebra** (vectors definition and manipulations (adding, subtracting, dot prod, cross prod); matrix definition and manipulation (adding, subtraction, product, inverse etc.), homogenous transformations);
 - **Trigonometry** (trigonometrical function definition and manipulation)
 - **Calculus** (derivate and integral use)
 - **Probabilities** (definition, and manipulation)
- **I have knowledge in physics:**
 - **Mechanics**
 - **Kinematics** (linear and angular velocities definition and composition)
 - **Dynamics** (Newton – Euler formalism; Lagrange formalism)
 - **Electrics** (passive and active elements definition and modelling, circuits computation)
- **I have knowledge in programming:**
 - **Python**

2) Knows about and is able to apply a fundamental systematic engineering approach.

- **I know the functional design approach** (the functions definition, the mechanical and electrical system design methods, the controller synthesis, the code generation, the tests methods)
- **I know algorithms for mechanical system design**
- **I know algorithms for electrical system design**
- **I know algorithms for the controller synthesis**

3. Is able to design formal models with regard to mechanical, electrical and computational aspects and is capable to model, simulate and design robots.

(i.e. modeling, mathematics, physics, knowing robotics concepts, canonical design procedures, understanding and explaining a robotics system, ...)

- **I use the Object Oriented paradigm in models construction**
- **I can design the geometrical model of the Robot**
- **Accepting the deterministic or probabilistic strategy I can construct:**
 - **the kinematical model of the Robot**

- **the dynamical model of the Robot**

4. Has knowledge of the fundamental mechanical, electronic and algorithmic and computer science concepts and is able to apply appropriate tools and methods required to configure and to implement a robotics system.

(i.e. structures and architectures, sensors, control, kinematics, navigation, electronic and mechanical engineering, building robots, programming robots, identify robot parts, computer science – programming robots using different languages (C++, Python...) having profound programming skills;

5. Works with real life equipment (robots).

- **I can use simulators to design and program tasks for real life equipment**

6. Integrates soft skills in robots design.

(Ethical aspects, social interactions, social impact, social, ethical and legal implications of robotics systems. ...)

- **I can design soft skills for Robots (integrating the ethical and social interactions aspects)**