# ROBOTICS AND SYSTEMS CYBER-PHYSICAL

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Embedded systems

## Description

The design of cyber-physical systems brings together all the digital science techniques that enable machines to acquire the ability to perceive, decide and act, in order to ensure that tasks are carried out autonomously and robustly in relation to a changing physical environment. A cyber-physical system is generally made up of sensors and actuators that enable interaction with the physical world, as well as digital hardware (electronic chips, micro-controllers, etc.) and software that coordinates the whole.

The term 'robot' is usually associated with cyber-physical systems that move or perform movements. However, the fundamental principles and methodologies underlying robotic systems can be found in a wider category of machines, interacting with physical phenomena other than movement (e.g. electrical or thermal installations, etc.).

At CRIStAL, the 'Robotics and Cyber-physical Systems' cross-cutting theme brings together activities on subjects related to automation, robotics and embedded systems, illustrated in particular by the PRETIL platform.

## 'Emblematic' projects

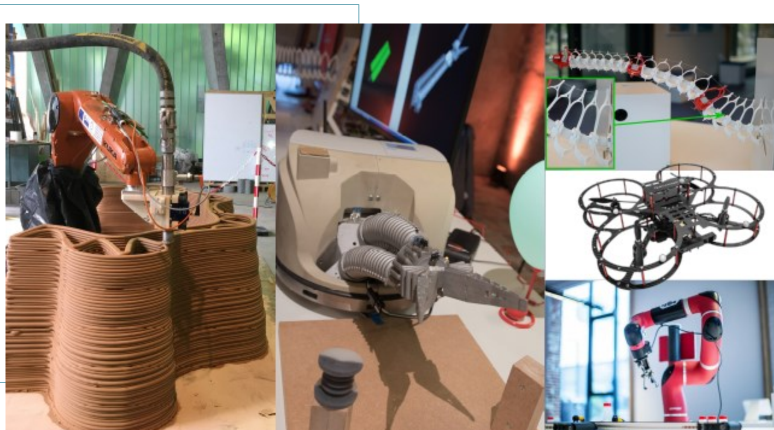
- H2020 UCOCOS, SimCARDIOTest, EU HORIZON SAFARI, IRE
- Interreg 2 Seas Mers Zeeën COBRA, Interreg NWE BEPROACT, Interreg NWE CIRMAP, Interreg 2 Seas SPEED
- Equipex+ TIRREX
- ANR PRCE ROBOCOP, PRC FINITE4SOS, WAQMOS, SPECULAR, COSSEROOT, DigitSlid, TURBO-TOUCH et NOCIME
- Tremplin-ERC COMOROS
- PEPR O2R
- COBOFISH_BPI, CUEIBOT_BPI, CHAMPIBOT_BPI

## Teams concerned

♠ ***GT CO2 (Commande et Calcul Scientifique):*** DEFROST, SHOC, VALSE

♠ ***GT ToPSyS (Tolérance Pronostic Système de systèmes):*** SoftE, ToSyMA

♠ ***GT SISE (Systèmes Informatiques Sûrs et Efficaces):*** SyCoMoRES



# Robotics and systems cyber-physical

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While in the history of automation the first applications were industrial (e.g. robotised production lines), today we are witnessing a massive deployment of embedded computer components in practically every field: robotisation of transport, smart homes, smart girds, medical robotics, automation of stock market trading, etc. This embedded intelligence can be found in a large number of everyday objects, carrying out tasks in a way that is transparent to the user (i.e. without the robotisation of the object being seen), sometimes in a way that is transparent to the user. This embedded intelligence can be found in a large number of everyday objects, carrying out tasks in a way that is transparent to the user (i.e. without the object being robotised), sometimes inter-connected via computer networks (particularly in the context of the Internet of Things).

From the point of view of the academic world, this massive deployment of interconnected embedded components has given rise to a number of research issues:

- Modelling, simulation and control of flexible robots
- Control of drones
- Robotization of vehicles
- Integrated design of robotic systems
- Design of electronic chips
- Modelling interaction with the physical world
- Analysis and programming of real-time systems with mastery of energy design
- Estimation of non-measurable physical quantities
- Design of feedback, diagnosis, supervision and fault tolerance algorithms
- Energy planning of cyber-physical systems
- Static analysis of software (bug detection)
- Verification of embedded software (formal proof of dependability, reconfiguration).

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