Robot simulators

Andrea Roli
andrea.roli@unibo.it

DISI - Dept. of Computer Science and Engineering
Campus of Cesena
Alma Mater Studiorum Università di Bologna

Simulation

Simulation is the imitation of the operation of a real-world process or system over time; it is based on experimenting with a *model* of the system. The model should capture the salient features of the system for the phenomena of interest.

- Requires a *model*.
- This model represents the key characteristics or behaviours of the selected physical or abstract system or process.
- The model represents the system itself, whereas the simulation represents the operation of the system over time.

Robot simulators

- A simulator is used to test ideas, software and even theories.
- It makes it possible to undertake tests in a **safe** and **controllable** environment.
- Prevents damage to the (often expensive) robot platforms and other objects.

- **It relies on a model of the robot and the environment**.
- The model is the result of an abstraction process: only the relevant elements are represented.

Disadvantages of simulation

- The model might not contain all the sufficient details relevant for the specific test to be made (e.g., forgot to include friction).
- Some key elements might not be correctly modelled (e.g., infrared sensors not correctly modelled)
- Simulation is often computational intensive.
- **Reality gap**.

Types of robotics simulators

General purpose:

- Physical engine with various features (e.g. 2 or 3-D);
- different robot models (possibly also open to new models written by the user);
- make it possible to define experiments depending on the user's requirements

Special purpose:

- Written *ad hoc*, for specific cases;
- the model accounts only for the relevant elements of the specific experiment to be run.

In this course

ARGoS — `http://www.argos-sim.info`

- Written in C++, open source
- multi-robot simulator
- multi-threaded
- multiple sub-spaces, each with a different physical engine
- it allows cross-compilation
- controllers programmable also in *Lua*

You may find more information on programming robots in Lua with ARGoS at:

`http://www.argos-sim.info/plow2015/`

ARGoS installation

1) Linux: `https://www.argos-sim.info/core.php`

2) VM – preferably VMware for compatibility with graphic libraries

3) For MacOS see Homebrew installation on `www.argos-sim.info/core.php`

4) Docker: `github.com/tylerferrara/argos3-docker/`

5) Windows: go to option 2 or 4

6) From sources: `https://github.com/ilpincy/argos3`