Formal Methods in Robot Control Systems

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Abstract

As more and more robots appear in human environments, the need for "correct", secure and proved robot behaviour arises. To be able to prove the "correctness" of the robot programs, a robot control system using formal methods seems to be the appropriate one. Formal methods can be used to prove the coherence and the correctness of the whole robot control system.

In this system, one user or several users give tasks to one or several robots, and then the robot or the robots try to execute the given tasks. Robot control systems using formal approach consist of the following parts: the task to be executed by the robots (the robot program code and its properties), the robot's hardware construction describing the robot abilities, the robot's environment (the "world's") description, and the "security" requirements (the constraints). These parts should all be formalised and specified. A formal verification system, can then verify the correspondence of the above mentioned different parts, checking whether a given robot's task properties correspond to the robot's abilities and to the security requirements and then verifies if the given task can be executed by the specific robot in the given environment.

Our work analyses these different points and tries to present some possible solutions using the Player Stage robot controlling environment and simulator by using the B formal method.

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