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RoboCalc : A Calculus for Software Engineering of Mobile and Autonomous Robots

Can Robots Ever Be Safe?

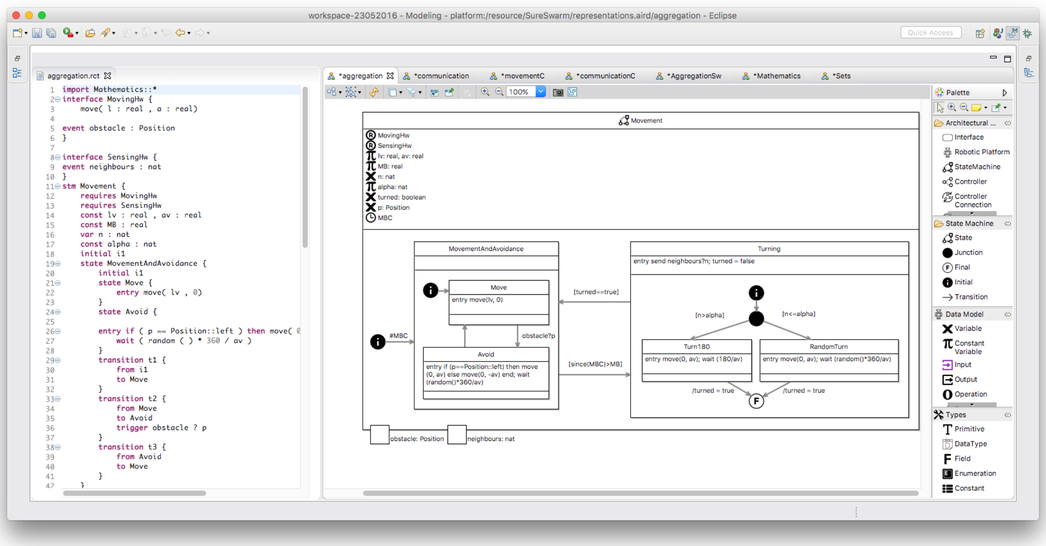
The multitude of possible applications of mobile and autonomous robots fascinates us all. When it comes to the realisation of all this potential, a limiting factor is the need to provide **evidence** of safety. The practice in development of robotic systems is not compatible with the modern outlook of applications. We are designing platform-independent notations for modelling and simulation. Their formal underpinning supports generation of reliable and concrete evidence of safety, and model-based development via property-preserving transformations. Early analysis reduces costs and traceability ensures maintainability.

Challenges

- Practical notations to model the environment
- Automatic generation of simulations
- Reasoning about collections
- Tractable approach to dealing with time and probability
- Heterogeneous semantic models: continuous, probabilistic, reactive

Modelling

- Eclipse plug-in supporting both graphical and textual specification notation.
- State-machine based notation with facilities to specify behaviour and data operations, as well as time properties and the environment.



RoboTool Eclipse plug-in

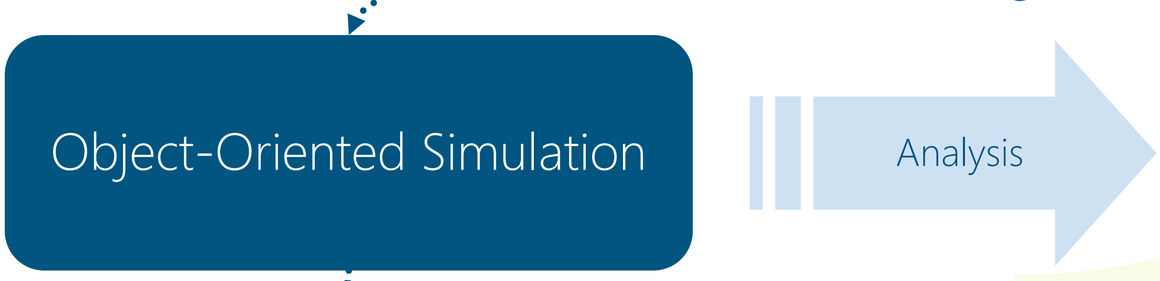
Controller example

Transformation

Simulation

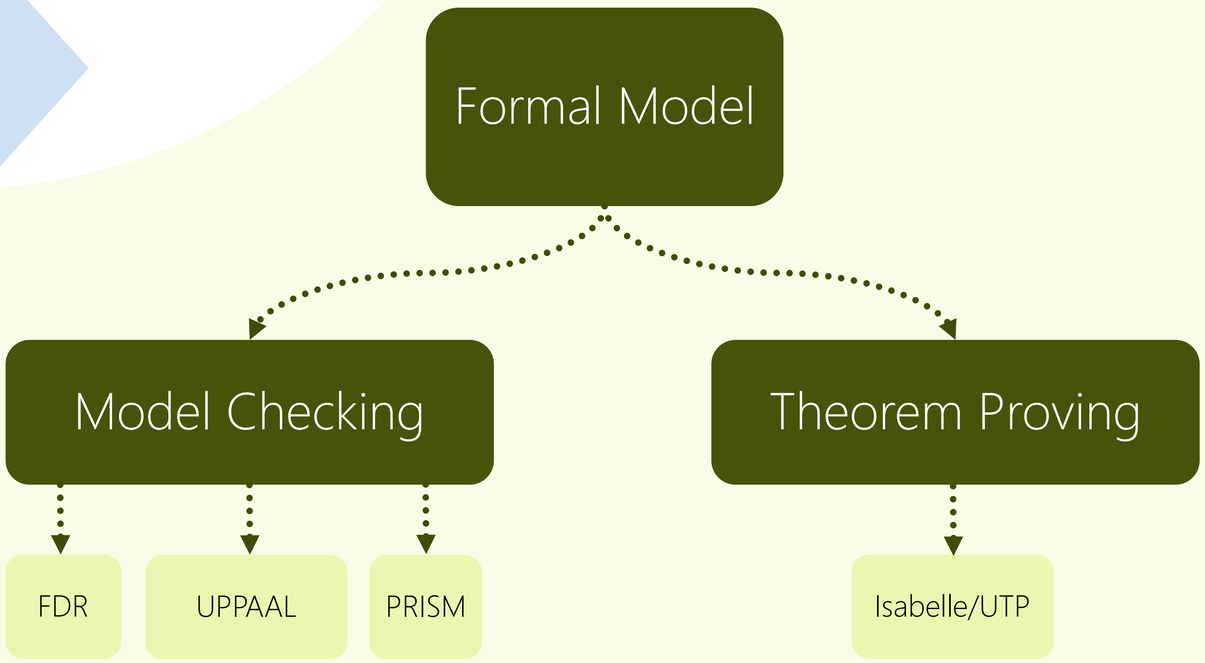
- High-level domain specific language
- Platform independent

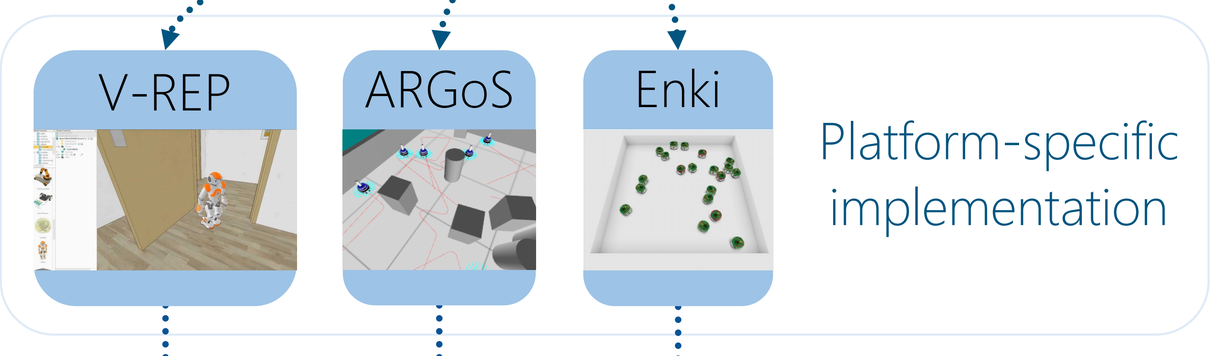
Automatic generation



Analysis

- Model-checking: FDR, UPPAAL, PRISM
- Theorem proving: rich semantics in Isabelle/UTP





Model checking using UPPAAL

Model checking using FDR3

Analysis

www.cs.york.ac.uk/circus/RoboCalc

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