Integrated Verification, Optimization and Learning

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Correctness and efficiency of complex autonomous systems is crucial. To get a holistic view, we integrate verification and optimization into one unified framework.

The focus of this project is on scheduling and planning of systems that include uncertainties from human operators. This include integration of correct-by-design control synthesis with optimization of desired system objectives. The synthesis is based on functional and safety specification in temporal logic and may include both controllable and uncontrollable/spontaneous dynamic behavior.

Background

Correctness and optimality is hard to combine in systems with large uncertainties, such as when a human operator interacts with the system. At the same time collaborative systems between robots and humans become more interesting in industry.

To face this challenge, correctness and optimality need to be further related.

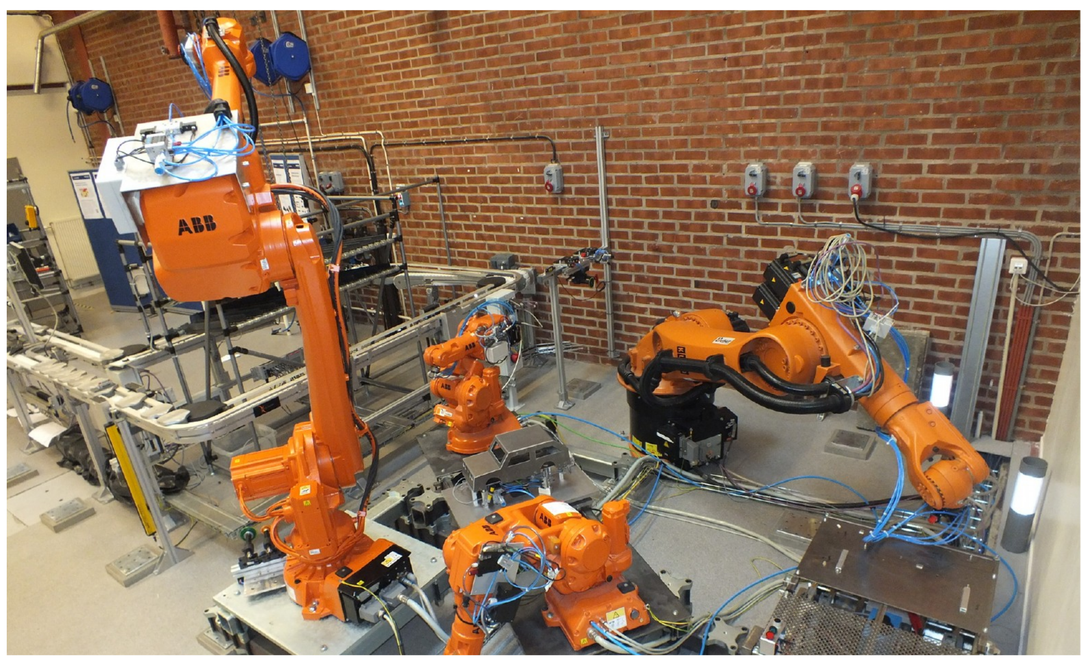
Research Goal & Questions

To obtain a unified framework that guarantees optimal and correct behavior of autonomous system implementations where uncertainties are present.

"*How can we integrate existing methods to schedule or plan processes with uncertainties from human operators.*"

Methods

- Functional and safety specifications in temporal logic ensures correctness of the solutions.
- Correct-by-design control synthesis is used to strengthen constraints to reduce state space.
- Find optimal plan by integrating traditional optimization, branching by simulation, incremental inductive reasoning etc.



The final result may be a pipeline from a description of the physical system to the final plan/schedule, using temporal logic specifications and control synthesis as middle steps in the process.