

Hydra

- Users**
- system engineer interested in assessing the capabilities of system being designed.
 - system engineer interested in generating controllers from a system model.
- Key features** Automatic synthesis for goal oriented "correct-by-construction" policies from a system model and an objective.
- Benefits**
- domain independent through the use of high level models of the system
 - no prior knowledge of the inner working of planning algorithms
- Inputs** Requires a hybrid model of the system:
- definition of the state of a system
 - definitions of the system's capabilities
 - available discrete actions and their effect on the system and its environment
 - operating limits of the controller
 - safety limits
- Specification of a target problem: initial state, goal state of the system and invariants that should hold.
- Outputs** A yes/no answer on whether the system can be used to achieve the tested use case.
A yes answer comes with a correct by design plan to achieve the given objective The plan accounts for both the discrete and continuous limits of the system so that the plan is valid and guaranteed to be executable and thus constitute a proof that the system has the targeted capability.

Example Usage Let us consider a robotic manipulator that is currently being designed. The mobile manipulator must be operated in a constrained environment in order to move objects into target locations. The system engineer has a specification of the controller which include the discrete actions (e.g. release object, scan environment) and limits of the system and of its controller (e.g. joint limits, maximal acceleration). Based on this model, the system engineer can test whether the currently designed system is capable of fulfilling a particular use case where Hydra will autonomously explore the set of possible high-level and low-level controls to achieve the target task. This would allow to verify that the system design is adapted to the targeted use case and catch modeling errors early in the design process. Once the design process is finished, Hydra can also be used as a goal-oriented controller to exploit the system.

- Role in the Toolchain**
- Exploitation of models and requirements for the generation of goal-oriented controllers
 - Verification of the system capabilities where a plan constitutes a proof that the modeled system is capable of fulfilling the required task.

Block Design

