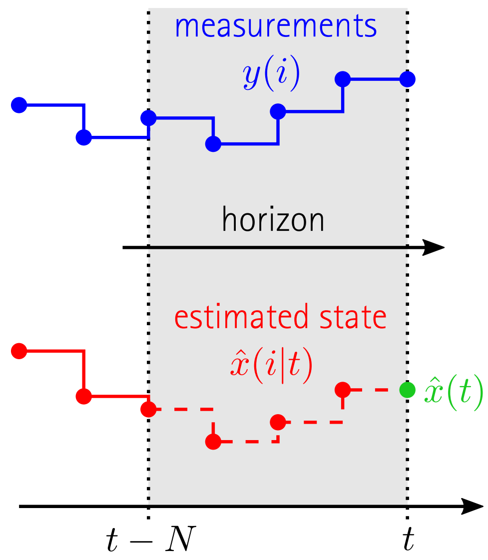
Institut für Regelungstechnik
Leibniz Universität Hannover

Leibniz Universität Hannover

Bachelor-/Masterthesis

Suboptimal approaches to optimization-based state estimation

Knowing the internal state of a dynamical system is crucial to solve many control problems, e.g. stabilizing the system via state feedback. In most practical cases, however, the state cannot be completely measured and therefore must be reconstructed using the (measurable) system output. When considering nonlinear systems with constraints, moving horizon estimation (MHE) has proven to be a powerful solution to the state estimation problem, and various theoretical guarantees such as robust stability properties have been established in recent years. In this method, the current state is estimated by optimization over a fixed number of past measurements, taking into account both system dynamics and constrained sets of decision variables. Since this approach requires the solution of a nonlinear optimization problem in each time step, MHE is computationally demanding and hence might not be real-time capable.



To address this issue, we are developing suboptimal schemes that do not require optimal solutions but still provide theoretical guarantees (e.g., robust stability).

Possible topics for Bachelor-/Mastertheses include theoretical works, e.g., the design of suboptimal MHE schemes and the derivation/analysis of their theoretical properties, as well as practical oriented works on simulation, implementation, and testing of newly developed algorithms with real dynamical systems.

Requirements: Theoretical foundations in mathematics and control theory.

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