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Output-Feedback Control of Uncertain Linear Systems

Differential equations with random coefficients are a widely used framework for modeling uncertainty arising from incomplete data, measurement errors, or external disturbances. In optimization and control, such uncertainties can substantially affect system behavior, making robust control a central challenge.

This talk focuses on robust feedback control for uncertain linear systems.

- First, the offline synthesis of feedback laws based on sampling and generalized polynomial chaos expansions is discussed.
- Then, a dynamic, data-driven framework that couples feedback control with sequential Bayesian parameter estimation is presented. In this setting, a virtual model evolves alongside the physical system and simultaneously serves as an observer, parameter estimator, and feedback controller. It reconstructs the system state via observer design, generates stabilizing feedback, and updates uncertain model parameters through Bayesian inference using measurements from the controlled dynamics.

Numerical experiments illustrate the effectiveness of the proposed framework and demonstrate robust closed-loop performance in the presence of parameter uncertainty.