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Non-Asymptotic Linear System Identification

Abstract: In this talk, we analyze well-known linear system identification algorithms that rely on the least squares algorithm. First, we focus on the identification of autoregressive systems with exogenous inputs, also known as ARX systems. By utilizing the tools presented in previous talks and contained in our tutorial paper, we establish a non-asymptotic, high-probability bound on the performance of the least-squares estimator. The bound describes how the system identification accuracy changes with the number of samples, the required confidence, and system-theoretic properties such as system size/dimension and signal-to-noise ratio. We also establish non-asymptotic persistency of excitation, that is, excitation of all the modes of the system with high probability, which is crucial for system identification. Next, we analyze the system identification of Markov parameters of state-space systems by reducing the problem to (approximate) ARX identification, which is a fundamental step for many subspace identification algorithms.

Keywords: System Identification, ARX Identification, State Space Identification, Persistency of Excitation, Non-asymptotic Analysis

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