Identification of Quantum Systems

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Abstract. The problem addressed is that of determining Hamiltonian parameters and/or the initial density matrix of a model of a quantum system with non-continuing discrete measurements, i.e., data is taken from repeated identical experiments at a finite number of (discrete) sample times. The method of Maximum Likelihood Estimation (MLE) is shown to a natural formulation for this problem. A distinction is drawn between estimating Hamiltonian parameters and the intial density. It is shown that the MLE of the Hamiltonian parameters has many local maxima whereas estimating the density matrix can be cast as a convex optimization problem. In the latter case an efficient numerical algorithm is presented using the barrier method. The issues involved in iterative adaptive control are also examined, i.e., iterating betweem an identification step and a control design step based on the identified parameters.