Fast Algorithms for Optimal Design and Learning Control of Quantum Dynamics

Herschel Rabitz
Department of Chemistry
Princeton University
Princeton, New Jersey 08544

Abstract:

Control of quantum dynamics phenomena has two generic features: theoretical control design and laboratory implementation. As the control of quantum dynamics phenomena is inherently a non-linear process, algorithms for design and laboratory implementation generally need to be applied in an iterative fashion, starting with an initial estimated control field, and hopefully, leading to a good converged solution. Achieving reliable algorithms calls for careful attention to issues of stability, robustness, and iterative efficiency. Although these issues apply both to computational design and laboratory implementation, these two activities have distinct features as well. When performing design, access is available to all aspects of the dynamics including the wavefunction, while in the laboratory, only direct observational information of the control or system can be exploited. These topics will be explored, along with illustrations of various algorithms including one for design purposes that exhibits monotonic convergence.