

Title: Quantum Optimal Control via Magnus Expansion and Non-Commutative Polynomial Optimization

Abstract: Quantum optimal control has numerous important applications ranging from pulse shaping in magnetic-resonance imaging to laser control of chemical reactions and quantum computing. Our objective is to address two major challenges that have limited the success of applications of quantum optimal control so far: non-commutativity inherent in quantum systems and non-convexity of quantum optimal control problems involving more than three quantum levels. Methodologically, we address the non-commutativity of the control Hamiltonian at different times by the use of Magnus expansion. To tackle the non-convexity, we employ non-commutative polynomial optimisation and non-commutative geometry. As a result, we present the first globally convergent methods for quantum optimal control. This is based on joint work with Jiri Vala (<https://arxiv.org/abs/2001.06464>).