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Free-Time and Fixed End-Point Optimal Control Theory in Quantum Mechanics: Application to Entanglement Generation[1] KENJI MISHIMA, KOICHI YAMASHITA, The University of Tokyo, JST-CREST, YAMASHITA LABORATORY TEAM — We have constructed *free-time* and fixed end-point optimal control theory for quantum systems and applied it to entanglement generation between rotational modes of two polar molecules coupled by dipole-dipole interaction. The motivation of the present work is to solve optimal control problems more flexibly by extending the popular *fixed-time* and fixed end-point optimal control theory for quantum systems to *free-time* and fixed end-point optimal control theory. Our theory can not only achieve high transition probabilities but also determine exact temporal duration of the laser pulses. As a demonstration, our theory is applied to entanglement generation in rotational modes of NaCl-NaBr polar molecular systems that are sensitive to the strength of entangling interactions. Using the tailored laser pulses, we discuss the fidelity of entanglement distillation and quantum teleportation. Our method will significantly be useful for the quantum control of non-local interaction such as entangling interaction, and other time-sensitive general quantum dynamics, chemical reactions.

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