Shortcut to Equilibration utilizing the Inertial Theorem

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We present a procedure to accelerate the relaxation of an open quantum system towards its equilibrium state. The control protocol, termed *Shortcut to Equilibration*, is obtained by reverse engineering the non-adiabatic master equation (NAME). This is a non-unitary control task aimed at rapidly changing the entropy of the system. The master equation has been derived from first principles, utilizing the *Inertial Theorem* in order to accurately describe the non- adiabatic open system dynamics. As an example, we study the thermalization of a particle in a harmonic well, demonstrating that for short times there is a three orders of magnitude improvement in accuracy. The protocol is utilized to realize a quantum Carnot engine model.