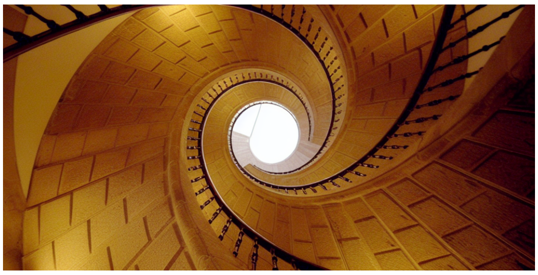

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Optimal control of dissipation and work fluctuations for rapidly driven systems

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To achieve efficient and reliable control of microscopic systems one should look for driving protocols that mitigate both the average dissipation and stochastic fluctuations in work. This is especially important in fast driving regimes in which the system is driven far out of equilibrium, potentially creating large amounts of unwanted entropy production. Here we characterise these optimal protocols in rapidly driven classical and quantum systems and prove that they consist of two discontinuous jumps in the full set of control variables. These jumps can be tuned to interpolate between processes with either minimal dissipation or minimal fluctuations, and in some situations allow for simultaneous minimisation. We illustrate our general results with rapidly driven closed quantum systems, classical bit erasure and a dissipative Ising chain driven close to a quantum phase transition.

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