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Abstract

Stability Under Limited Control in Weakly Dissipation Cyclic Heat Engines †

Julian Gonzalez-Ayala [1], Alejandro Medina Dominguez [2], Jose Miguel Mateos Roco [2] and Antonio Calvo Hernández [2]

[1] Instituto Universitario de Física Fundamental y Matemáticas, Universidad de Salamanca, Salamanca, Spain
[2] Departamento de Física Aplicada, Universidad de Salamanca, Salamanca, Spain
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In this work we study the effect of natural stability mechanisms in stochastic trajectories produced by deviations of the operation regime due to fluctuations on the heat exchanges between the heat device and the thermal reservoirs. Perturbations on the operation regime from external sources produce stochastic trajectories along one cycle and the energetic consequences of the restitution forces are then analyzed. The main energetic functions such as power output, efficiency and entropy production, as well as compromise based functions are analyzed and the role of the stability basin, the so-called nullcline (which determine the restitution strength) and the endoreversible and irreversible limits (linked to a thermodynamic optimization) are put together to establish a connection between stability and a self-optimization feature.

The return maps of the dynamics allow us to understand the biggest contribution of the stability in the energetic evolution of the system. Additionally, fluctuations of the thermodynamic functions allow us to deepen into the susceptibility of each energetic function.