CATALYTIC ENHANCEMENTS IN THE PERFORMANCE OF MICROSCOPIC TWO-STROKE ENGINES

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Abstract

We demonstrate how to incorporate a catalyst to enhance the performance of a heat engine. Specifically, we analyze efficiency in one of the simplest engine models, which operates in only two strokes and comprises of a pair of two-level systems, potentially assisted by a d-dimensional catalyst. When no catalysis is present, the efficiency of the machine is given by the Otto efficiency. Introducing the catalyst allows for constructing a protocol which overcomes this bound, while new efficiency can be expressed in a simple form as a generalization of Otto's formula: $1-\frac{\omega_c}{d\omega_h}$. The catalyst also provides a bigger operational range of parameters in which the machine works as an engine. Although an increase in engine efficiency is mostly accompanied by a decrease in work production (approaching zero as the system approaches Carnot efficiency), it can lead to a more favorable trade-off between work and efficiency. The provided example introduces new possibilities for enhancing performance of thermal machines through finite-dimensional ancillary systems.

Venue

PAMU Seminar Room

A.N. Kolmogorov Building, ISI, Kolkata

Date & Time

22 January, 2025
03:00 PM

Everyone is invited to attend