Thermodynamics of feedback controlled systems

Francisco J. Cao

Departamento de Física Atómica, Molecular y Nuclear, Universidad Complutense de Madrid,
Avenida Complutense s/n, 28040 Madrid, Spain

We compute the entropy reduction in feedback controlled systems due to the repeated operation of the controller. This was the lacking ingredient to establish the thermodynamics of these systems, and in particular of Maxwell’s demons. We illustrate some of the consequences of our general results by deriving the maximum work that can be extracted from isothermal feedback controlled systems. As a case example, we finally study a simple system that performs an isothermal information-fueled particle pumping.

Figura 1. Illustration of the Markovian particle pump with \( n = 2 \) lattice sites between barriers. This is a simple example of a feedback controlled system that extracts useful work from the entropy reduction due to the information about the system used by an external feedback controller.

---

\(*) francao@fis.ucm.es