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Title: Prior Information in Inference of Performance in Constrained Thermodynamic Processes

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Abstract: In the present thesis, we explore the relevance of the prior information in classical thermodynamic processes with limited information to estimate their performance characteristics. We followed the Bayesian approach where all uncertainty is treated probabilistically and a probability may be assigned to an uncertain parameter taking up a possible value. The corresponding probability distribution is simply known as a prior. In the present context, we propose appropriate priors in case of limited information about the thermodynamic coordinates of the process. First we consider the process of reversible work extraction with identical thermodynamic systems in which input heat from the source is converted into work with delivery of the waste heat into sink, preserving the total entropy of the composite system. The work extracted and efficiency of the engine is estimated. The estimates show good agreement with the optimal work extracted and the corresponding efficiency especially near equilibrium. The inference approach also extended to non-identical systems reproduces the optimal behavior to a good extent. Next, we consider the well-known process of pure thermal interaction between the two systems with fixed total energy. The main quantity of interest is the estimated net entropy production which matches with the corresponding optimal value upto third order. An intuitive interpretation for the prior is also proposed.


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