Review of: "Comparison of extended irreversible thermodynamics and nonequilibrium statistical operator method with thermodynamics based on a distribution containing the first-passage time"

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Potential competing interests: No potential competing interests to declare.

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Comments to the Author(s)/Editor(s)

Summary:

The paper "**Comparison of extended irreversible thermodynamics and nonequilibrium statistical operator method with thermodynamics based on a distribution containing the first-passage time"** deals with the analogy between a version of non-equilibrium thermodynamics distribution-based containing an additional thermodynamic first-passage time parameter, nonequilibrium statistical operator method and extended irreversible thermodynamics with flows as an additional thermodynamic parameter. The overall result of this work demonstrated a relation which relates the parameter γ to the change in entropy and fluxes. The authors found expressions for the thermodynamic parameter, the conjugate of the first passage time through the entropy change, and for the average first passage time through the flow.

Scope:

This manuscript falls within the scope of thermodynamics containing an additional thermodynamic first- passage time parameter maps to extended irreversible thermodynamics.

Originality

There are numerous previous studies that have shown the direction in non-equilibrium thermodynamics, in contrast to equilibrium one; the authors are certainly familiar with these studies as their bibliography cites some previous efforts in this area (e.g., Page 1). Thus, the proposed model, being evaluated and tested through statistical parameters is not a novelty. However, the proposed model is significantly contributing to non-equilibrium/equilibrium thermodynamics. Ideas or techniques that are not new but are approached in an original way.

Scientific rigor:

The theoretical predictions and the models described in this paper are presented in detail and, in my opinion, it can be

reproduced based on the manuscript methods. The authors described the distribution of the NSO in the case of the classical description equated to the distribution containing the FPT.

Significance:

The paper does not advance the field significantly but have archival value. Previous studies have shown similar conclusions as the author's research.

Clarity:

The work is well-written and clearly communicated, with several minor concerns regarding writing.

Structure:

The purpose of this study was to obtain an explicit expression for the thermodynamic parameter conjugate to FPT, an analogue of the reciprocal temperature, conjugate random energy, depending on the change in entropy. Then this expression was obtained in a general form.

Length:

This manuscript is long, at about 21 pages of content and almost 5 pages of references. This is due to study itself. I do not have any areas I would suggest being removed.

Title: The title is sufficient.

Abstract:

The abstract generally describes the work of the manuscript well and is sufficient. It should state the results obtained in the study.

Conclusion:

The conclusion summarizes the work well and describes how the dependences of the FPT distribution density on random energy change the simplest picture of independent variables and create opportunities for a more detailed and in-depth description. The article considers the simplest case of linear dependence. It illustrates how the description becomes more complicated, new dependences on the parameter γ appear, and through it on the change in entropy and flows. Setting the dependence of the FPT distribution on random energy depends on the specific task, and I think that the conclusion is sufficient and provides closure to the work. The conclusion section should not contain any references.

References:

In general, the references are reasonably up to date, appropriate, and consistently formatted. There are also many old references (see reference 1-7) maybe useful for this study.

The manuscript has been revised and the following comments should be considered:

1. The paper has good English structure, but some number coherence and other issues can be revisited.
2. The introduction provides sufficient background. Please avoid lumped references, see for instance [34-43], [49-68], [8-13], [20-33] and others in the introductory section. If you are citing them, please elaborate the discussion about what other authors have studied and which is the difference between their findings and yours.
3. Basic concepts of the subject are well described, but the paper is not ambitious enough from the scientific point of view. It should be improved in the comparison between an experiment and the model. We need to understand the causes. Playing with numerical models is not per se actual science. Some additional work along this line, is recommended.
4. The conclusion section **should not contain any references**. It should show only the conclusion of the author study.

Conclusion:

In conclusion, the manuscript **PEW9VS** is well presented. It could build up for further studies on this subject. So, overall, I think that, if the above comments are addressed the manuscript will be ready for publication.