**Manuscript No.:** #23080

**Title:** Impact of Fuel Element Shape on Material Testing Reactor using OpenMC Code.

Thank you for your valuable feedback on the paper. We appreciate your input and have carefully considered your suggestion comments as shown below.

|  |  |  |
| --- | --- | --- |
| **Comment No.** | **Comments, Replies, and Changes made** | |
| **1** | **Comment** | **Considering this paper is build on previous study I recommend it for poster session. The paper have not very much to offer in terms of the complexity of the analysed problem nor applied assumptions.** |
| Reply | Thank you for your recommendation and feedback on our manuscript.  While there are apparent similarities between the two studies, particularly the curved vs. flat comparison, there are also significant differences that set our research apart.   1. **Objective and Methodology**: The previous study was primarily focused on evaluating core parameters of the MTR using curved fuel plates. It further sought to validate OpenMC by comparing it with other Monte Carlo codes (MCNP and SCALE), and then altering the fuel shape. In contrast, our research zeroes in on the impact of simulating different fuel shapes for the MTR in a smaller, controlled volume. We specifically eliminated other components that could influence the parameters during shape changes. 2. **Study Geometry**: The previous work used a full core geometry, whereas our study focuses on a 2D infinite bare reactor. This approach allows us to specifically target the fuel shape in the XY direction without the influence of other materials that could potentially alter parameters through absorption or reflection. 3. **Neutron Generation**: In our recent study, the number of neutrons generated was significantly multiplied, which not only reduced uncertainties but also required extended running times. 4. **Spatial Distribution Visualization**: A notable distinction is our visualization and analysis of the spatial distribution of flux and fission among fuel elements – an aspect not covered in the previous study. 5. **Stochastic Volume Estimator**: Our research introduces the use of a stochastic volume estimator. This ensures that the fuel amount differences between the two shapes don't disproportionately affect other parameters. Such an estimation was unique to our study.   It's also important to note that while certain assumptions remain consistent between the two studies (relying on multiple prior studies specific to the same reactor, MSTR), the aforementioned differences underscore our study's distinct contributions. |
| Change made | Not change has been made. |
| **2** | **Comment** | **The core is at room temperature, with uniform neutron distribution - which is quite unrealistic.** |
| Reply | This assumption has been considered in all previous. However, since, we are focusing on the shape impact, the changing in temperature gradient or the neutron sources distribution shall add extra parameters to the study. |
| Change made | No changes. |
| **3** | **Comment** | **Chapter III.D lacks specific information about actual volumes that resulted from OpenMC estimation.** |
| Reply | Thank you for your comment, OpenMC has a capability to stochastically determine volumes of cells, materials, and universes. The method works by overlaying a bounding box, sampling points from within the box, and seeing what fraction of points were found in a desired domain. The benefit of doing this stochastically (as opposed to equally-spaced points), is that it is possible to give reliable error estimates on each stochastic quantity. For that manner, it will use the same material & geometry that used for both models. Noting that, we are dealing with 2D, since that we add a temporary thickness in order to be performed and calculated. However, it is still an estimator to calculate the differences between the two shapes in OpenMC prospection. |
| Change made | Addition of “temporary height has been performed in order to calculate the volume.” |
| **4** | **Comment** | **Through-out whole paper authors use the term "k-eigenvalue" in text but used "k\_eff" in equations and tables. Please use "k\_eff" everywhere.** |
| Reply | Thank you very much for this great comment, since we are dealing with periodic boundary condition, it will be much fitting to use the term k-inf rather than k-eigenvalue as describe in the chapter I and chapter III (Boundary and Material Setup). |
| Change made | All k-eigenvalues are changed into k-inf. Except that paragraph describing the OpenMC outputs. |
| **5** | **Comment** | **There is a type-o in chapter II.D. The text says "(...) using equations (1) and (2) (...)". I think the authors mean equations 4 and 5.** |
| Reply | Thank you for the comments, the typo has been resolved. |
| Change made | Typo has been resolved, |
| **6** | **Comment** | **Figures 4 and 5 do not present any readable comparison. If authors possess the data for the flux in "flat" and "curved" materials, they should plot the difference between them. However, considering "uniform neutron distribution" (un-realistic assumption) there is no difference to be expected. Thus, comparison is not interesting and un-important.** |
| Reply | Thank you for this notice, the main purpose of those figure is to show how the fission distribution are between the two shapes (curved and flat), this can give an idea to distinguish the areas of fissions between the shapes.  Moreover, the case of “uniform neutron distribution,” actual, the assumption is “uniform neutron source distribution,” means neutron-producing source that emits neutrons uniformly, i.e., at a consistent rate and without favoring any specific direction. However, in our case the, the fuel is fresh with uniform enrichment, temperature and coolant is static. We do not have any source localization, control elements nor reflectors. Since then, choosing neutron source uniformly distributed is suitable for this study.  Never the less, additional figure that illustrates the difference in fission distribution has been produced. |
| Change made | additional figure that illustrates the difference in fission distribution has been produced. |
| **7** | **Comment** | **In chapter "V" a phrase states that "differences are within acceptable range". This acceptable range was never defined and considering that authors are investigating this issue, these results/differences should never be compared in that manner.** |
| Reply | Thank you very much for this comment, this is right. |
| Change made | "differences are within acceptable range" statement has been removed. |
| **8** | **Comment** | **Both in chapter I and V authors draw "grandeur visions" of the "revealing the relationships" between fuel shapes, "gaining insights from this investigation" and expect "improvements in reactor performance, safety and efficiency" and then proceed to apply the least realistic working conditions for modelling.** |
| Reply | Thank you for your comment. We chose the simpler 2D setup and used assumptions like a consistent room temperature and neutron *source* distribution on purpose. This setup helps us clearly see how different fuel shapes work without other distractions. It's a starting point, and while it's basic, it gives us useful information for later, more detailed studies. We understand it might seem too simple, but for this study, it is open that any study that related to reactor performance, safety and efficiency shall consider the fuel shape.Top of Form |
| Change made | No change has been made. |
| **9** | **Comment** | **Finally the narrative is shifted from "significant reactor design improvements and optimization" towards the fact that the difference are barely observable and that the "curved" geometry can be simplified to "flat geometry".** |
| Reply | Thank you a lot for this note, the statement is “Ultimately, the study's findings will contribute to a better understanding of how fuel element geometry affects reactor parameters, which can have significant implications for future reactor design and optimization efforts.” Which targeting the future of work giving the notice of that, simplified geometry (even small) can lead to different output, which is not suitable for detailed investigation. However, simplification of the geometry can be helpful to understand the overall behavior of this kind of fuel elements. |
| Change made | No change has been made. |