Response to reviewer comments

Paper Title: Representation of the Few-Group Homogenized Cross Sections of a MOX Fuel Assembly

Paper ID: 311

**Reviewer 1:**

Comment:

Title: The initial letters of all words in the title, except the first, should be in lower case, as stipulated.

Author’s response:

The title has been amended to comply with the stipulation.

Comment:

Author \*affiliations\* should also be in 11pt font, as stipulated.

Author’s response:

The paper was written using the Latex template that was supplied on the conference website. Due to the nature of Latex, page layout and formatting parameters such as fonts are determined by external style files, in this case the jpconf.clo and jpconf.cls files that were supplied with the template. The authors are hesitant to make changes to the officially supplied files, and have manually increased the text size of the author affiliations by over-riding the style specifications inside the Latex file. It would be preferable for the organizers to update the style files so that they conform more closely to the specifications, and the authors are ready to re-compile the document when and if these updated style files become available.

Comment:

Include the country in each affiliation.

Author’s response:

The countries have been added to the affiliations, as requested.

Comment:

Align table captions with tables.

Author’s response:

The table captions have been appropriately aligned with the tables.

Comment:

References to figures in the text should have 'figures' all lower case except when at the start of a sentence, as stipulated. Similarly, references to tables should take the form 'table n', not 'Table n'.

Author’s response:

The text was amended accordingly.

**Reviewer 2:**

The paper summarises the application of an advanced cross-section parameterization method to MOX type fuel assemblies. As far as I am aware, the application of the technique to MOX PWR type assemblies has not been performed before and as such allows for an interesting analysis. The work is quite extensive, clear and conclusions show some interesting phenomenon. A very good paper. Some specific comments and suggestions (not mandatory):

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Comment:

It would be valuable to overall understanding of the paper that the underlying reason for using six groups (as opposed to two) for MOX type fuel is discussed also, in order to make it clear that the parameterisation error contribution to the group structure, although notable, is still a second order effect when compared to the environmental error.

Author’s response:

The last two paragraphs of the Section 1 (on page 2) were amended to clarify the reason why the effect of the energy discretization was included in this study. The changes also clarify the distinction between the effect of a model improvement on the full calculation and on the representation accuracy. A similar disclaimer was added to the last paragraph of Section 4 on page 6 in response to another reviewer comment.

Since the focus of this paper was purely on representation accuracy, only the model improvement that has the most direct impact on the way in which cross sections depend on the state parameters was taken into account. The authors were, unfortunately, not able to find a reliable reference that compares the relative importance of the various model improvements and will therefore refrain from speculating on this.

Comment:

A small subset of the full range of calculated results are presented and discussed. Although the selection is well motivated, it would be good to include some overall statistics on mean and maximum fit error for all isotopes and groups.

Author’s response:

The subject of this paper is a limited, self-contained part of a larger master’s project. The limitations on both the scope of the paper, as well as the results presented, were necessitated by the strict page limit imposed by the conference organisers. A full analysis of all results from the larger study, including the results requested by the reviewer, will be made available in the MPhil dissertation that is currently under review. The details of this dissertation are as follows:

* Author: Saymore Chifamba
* Title: A study of the performance of a sparse grid cross section representation methodology as applied to MOX fuel
* Institution: University of Johannesburg
* Year: 2014

Comment:

Please give the polynomial order used for some of the difficult parameters, as opposed to only the sparse grid order.

Author’s response:

The way in which the interpolation is constructed does not naturally yield information on the degree of the interpolating polynomial in any one dimension. Although this could be extracted, this functionality was not included in the tools that were used to perform this study, and therefore the requested information is not available.

Comment:

Although, based on my experience, the method seems to perform well, there is no comparison with the accuracy of some traditional methods in order to place the benefits of this method clearly. If such results are available (for e.g. a linear table interpolation), it would be highly beneficial to add it.

Author’s response:

Such a comparison is planned for the near future, but falls outside the scope of this paper.

Comment:

Some small typographical and grammatical errors remain, which should be corrected.

Author’s response:

The typographical and grammatical errors that were identified have been corrected.

**Reviewer #2**

Comment:

Page2 Par 2. Please use 6.25 x 10-1 eV; This is the well known thermal cut-off. The use of the rounded 6.3 x 10-1eV will confuse the reader. The exact energy boundaries are important.

Author’s response:

The energy group boundaries were updated to be more precise in the second paragraph of Section 2, as well as in the second to last paragraph in Section 3

Comment:

Table 1: The use of densities at hot conditions only (no density close to 1g/cm3) while the moderator temperature is also given at cold conditions is confusing. No need to redo the study - just add a remark to the text.

Author’s response:

The moderator density interval boundaries in Table 1 were typed in incorrectly. The results presented in the paper are a small subset of a wider study, which also included cross section representations that were constructed on a smaller state parameter space that would be appropriate for steady state operational simulations. The moderator density interval that appeared in Table 1 was, unfortunately, the one for the operational conditions. The correct figures have now been inserted into the table on page 3. The authors have confirmed that this was merely a typing error and that the results were indeed produced by calculations that were performed with the correct, updated moderator density interval.

Comment:

Page 4 footnote: Not clear what target? Target accuracy?

Author’s response:

The target is referring to the target accuracy, and the footnote on page 4 now reflects this.

Comment:

page 5 last par. The saving in library size is clear but not the computational expense. The number of sparce grid points needed to obtain the required accuracy is determined by the thermal energy group(s) cross section accuracies and the number of transport calculations basically the same for the 6-group and 2-group libraries (Table 2). Since all cross sections is calculated in any case in each transport cross section calculation is the number of cases not determined by the larger number? Or what do I miss.... If each cross section is calculated independently (so a set of cross sections is not used for all energy groups but only one per transport calc.. it is of course clear why a saving is obtained) - Please clarify in paper / explain a bit more. (and fix the typo "an" vs "and" the size of the cross section library).

Author’s response:

The paragraph has been removed. The reviewer’s comment makes it clear that the paragraph was poorly formulated and included speculation that is only tangential to the discussion of the central premise.

Comment:

The claim that the cross sections "space" include transient analysis is important (and mostly true) but the cold fuel and moderator temperature that is not supported by the "cold" density close to 1g/cm3 makes this claim problematic - please revise or clarify in the text - what transient space....

Author’s response:

This comment is also addressed by the correction made to table 1 on page 3.

Comment:

Perhaps a disclaimer in the conclusion - after (as part of) the second last par is needed. I agree that excellent results are achieved but this does not (necessarily) imply that the results of the nodal calculations will be so accurate - refer to the introduction where it was stated "Nodal methods may be less accurate when applied to cores that contain MOX fuel..". This problem was not investigated... although the six-group library may be the solution. The "error" in these MOX cases is not introduced by the cross section representation model BUT rather by the group collapsing and homogenization errors. It will be good to make sure the reader understand this / make the distinction between the "cross section reconstruction error" that was minimised as shown here and "model limitation errors" due to homogenization and group collapsing that is the actual MOX error... (that was not investigated as part of this paper)

Author’s response:

A disclaimer to this effect was added to the last paragraph of Section 4 on page 6.