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12/15/2017

Dr. Jeremy A. Roberts
Assistant Professor
Department of Mechanical and Nuclear Engineering
Kansas State University
Manhattan, Kansas, 66502

Dear Dr. Roberts:

Please find enclosed my manuscript, *Coupled thermal stratification and natural circulation modeling*, which I would like to submit to you as part of the course requirements of ME 701.

This paper explains how the mass, momentum, and energy of a liquid metal loop, KSU NuEST Lab's GaTE (Gallium Thermal-hydraulic Experiment), can behave under transient natural circulation scenarios. The temperature distribution has been solved for, both in time and in space, throughout the loop. In order to allow the audience a full view of the parameters of the loop, the information has been animated. The animation will help illustrate the time evolution of the natural circulation transient.

The manuscript, attached here, is also available, with all supporting code, on the GitHub repository: https://github.com/brendanwardksu/GaTE_NC

Reviewer comments have been provided and addressed. Their resolution is documented on the following page of this letter.

I thank you for your consideration and look forward to your decision.

Sincerely,

Brendan Ward

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Reviewer Responses:

In this document, the author has tried to address all the comments and questions raised by reviewers. The author is sincerely thankful to reviewers for their valuable comments which have improved the final product. The author hopes that they have implemented or answered all the comments to the reviewers' satisfaction.

Reviewer 1:

1. Section II, list item number three: Modelling should be Modeling.

2. Section IV, first paragraph, first sentence modelled should be modeled.

All instances of modelling/modelled have been changed to modeling/modeled.

3. Has the size of the time step been determined in a way that the solution is guaranteed to converge?

Short answer: no, but great question. No grid size /convergence studies were performed really. Two dts were mapped (0.2s and 1s) but their effects show no difference. This doesn't explain the 'diffusion' of the temperature front numerically (not physical since thermal diffusion wasn't modeled). A section in the results section includes discussion of this.

4. There is no link to the actual code or github repository.

A link to the github repository has been added.

5. Figure 3, upper left hand plot has no legend.

All of the plots have been modified for enhanced clarity. This includes adding a legend here.

Reviewer 2:

1. Reference equations used in this section

These are fundamental equations of energy and momentum. No references are included.

2. Clean up plots

Plots have been cleaned up.

3. Use something to distinguish curves in spatial distribution plot. (legend, etc.)

The multiple curves are an artifact of not being able to show the time evolution. There is only one curve (and a steady state reference curve) in the animation. A legend has also been added.

4. *English errors in first paragraph*

English errors have been corrected.

5. Discussed the fact that solutions were found, but conclusions about the plots presented, qualitatively or quantitatively were not mentioned.

The results section has more of this information now.

6. Possibly discuss the usefulness of the animation? Why that is better than just plots?

This was discussed in the abstract, but an additional wording has been added throughout now. Temperature in the loop is two-dimensional (time, space) and, while it is easy to see the distribution in space at a given point in time, seeing the distribution in space at every point in time can be cumbersome to the audience.

7. Why was python chosen as your solver as opposed to something like c++ or fortran?

The engine driving the solution is not computer intensive. Since the algorithm was intended to be animated, Python was chosen for ease of communication between results and displayed output.

8. Include a link to your code, please.

Included.

9. Font of variables written in text bodies don't match font in equations (italicized).

Variables in the text body have been updated.