24.536 Reactor Experiments and 407.403 Advanced Nuclear Lab

HW #7: "Reactivity Measurements Techniques" Post-lab Exercises

Introduction/General Tasks

The purpose of Reactor Experiment #2 is to use a variety of reactivity measurement techniques to actually measure reactivity levels and reactivity changes in a real reactor. In the pre-lab exercises (i.e. HW#6), you used some simulation tools to predict the expected behavior, but now you have real data to actually measure these quantities. Thus, for the post-lab phase of this experiment, you should isolate each phase of the experiment and, using the methods discussed in class and in the pre-lab exercises, you should analyze the measured data to extract the desired quantities of interest. Also, be sure to compare the measured results with data that can be obtained from the available blade worth curves specific for the current UMLRR core, and evaluate the accuracy associated with each of the methods illustrated in this experiment. Also, briefly summarize your in-lab and post-lab data and results from the experiment, along with some discussion of your methodology and any important observations from your work.

The specific tasks and deliverables for this post-lab assignment are described below:

Summarize Results from Reactor Experiment #2: Reactivity Measurements Techniques

A list of tasks needed to complete your post-lab analyses is given below. Please include your responses, analyses, and discussions, as needed, for each of these tasks as part of your complete package for HW#7.

Extremely Important Note: When post-processing the history file from this experiment, make sure you get the time interval of interest exactly correct for each phase of the experiment -- since it is essential that this be done correctly if you hope to get reasonable results here. Also, you should go back and carefully study the codes used to process the archived history file from HW#1 -- in particular, focus on the Matlab functions **read_datfile.m**, **plot_PTB.m**, and **gettagloc.m** that were used within the **fdbk_rho_081612.m** main program to read and process the data of interest for that demo. You will need to use similar techniques to properly extract and process the data for the current experiment. Accessing and processing the data for the four phases of this experiment involve a bit of work, so be sure to get this process started early and give yourself plenty of time to do this HW correctly. Once the needed reactor data are available, then the m-files used in the four HW#6 pre-lab demos should be helpful in performing the actual post-processing tasks requested below.

1. Summarize the goals of the experiment and the overall steps/procedures that were performed.
2. Process the data from the Phase I tests and use the **Stable Period Method** to determine the amount of reactivity inserted for both the positive and negative reactivity transients that were performed. Compare your measured data to that obtained from the blade worth curves.
3. Estimate the reactivity worth associate with the insertion of the startup source at the beginning of the Phase II test. Is this as expected? Explain…
4. Using the **Rod Drop Method**, estimate the amount of reactivity inserted when Blade #1 was dropped into the core. How does this compare with the $\Delta\rho$ obtained from the integral worth curves for Blade #1?

5. Using the **Subcritical Multiplication Factor Method**, estimate the worth associated with the Phase III test, and again compare to information that can be obtained from the blade worth curves. Use an estimate for the subcriticality level prior to the reactivity change from the Phase II tests. Explain…
6. Finally, using the **Source Jerk Method**, estimate the subcriticality level at the beginning of the Phase IV sequence.
7. As closure for this lab exercise, also briefly discuss your overall experience from this reactor experiment -- that is, do you now have a better feel for various reactivity measurement methods within both critical and subcritical systems? Also, has doing the above analyses helped in your understanding of the usefulness of the integral blade worth curves? Finally, also please comment on any changes that could be made in future experiments of this type to improve the overall learning experience for the class -- your feedback here could improve the learning experience for future students…

Documentation and Submission of HWs

In general, I expect a professional, well-written, semi-formal report for each HW assignment in this course. Please refer to HW#1 regarding the format for each HW assignment in this course -- **they should all be done and submitted in a similar fashion!!!**

For this HW, you need to post-process the measured data for each phase of the experiment and discuss these data and the measured reactivity worths -- and how these compare to data obtained from the current blade worth curves for the UMLRR. As done previously, please put everything together, including all your Matlab m-files used to post-process the experimental data, in a single zip file -- **only one zip file per HW please** -- and **email this to me before 4 pm (UML time) on the Sunday just before our next class**.

Good luck -- and remember that this HW is a bit time consuming, so get started early…