

HOMEWORK 3 - MAY 2023

Referring to the attached papers, perform a stability analysis of a Generation-IV design (select between VHTR, SFR, GFR or LFR) or the TRIGA Mark II reactor. For every reactor, the minimum requirement is to use neutronics + thermal hydraulics, ignoring the secondary loop (but you can add it if you want). Follow the step below:

Step 1) Study the linear model.

- Linearisation of the model.
- Construction of the state space matrices.
- Evaluation of the State Space and the step response
- Compute the eigenvalues and plot them.
- Plot the stability map using the feedback coefficients.

Step 2) Compute and solve the nonlinear model.

- Consider a reactivity insertion of 100 pcm ($\alpha_H = 10 \text{ pcm/cm}$)
- Plot the main quantities of interest.
- Verify if the nonlinear model results agree with the linear ones (i.e., check if for different values of the couple of feedback coefficients the nonlinear model and the stability map say the same thing)

Step 3) Implementation of the controller

- Model-controller integration (see attached code for the PWR). Implement only the PI controller, without the derivative term.
- For α_H use the calibration obtained during your experience at the TRIGA reactor (23 May 2023), regardless of the selected design.
- (Optional) What happens if we have noisy inputs?
- Check that you don't have overshoot in the power.
- Perform a parametric analysis on the system gain.