NPRE 560 Fall 2024
HW 3 Due 2024.10.23

- Show your work.
- This work must be submitted online as a `.pdf` through Canvas.
- Work completed with LaTeX or Jupyter earns 1 extra point. Submit source file (e.g. `.tex` or `.ipynb`) along with the `.pdf` file.
- If this work is completed with the aid of a numerical program (such as Python, Wolfram Alpha, or MATLAB) all scripts and data must be submitted in addition to the `.pdf`.
- If you work with anyone else, document what you worked on together.

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1. (Ott Review 6.20) Describe in words, with graphs, and with formulas the transient following a step change in reactivity or source:
   (a) (5 points) Without delayed neutrons.
   (b) (5 points) With constant delayed neutron source.
   (c) (5 points) With no approximations (no formula required).
2. (Ott Review 6.34) Estimate the time it takes to establish the stable asymptotic transient for $\rho_1 < \beta$ in an initially critical reactor.
3. (10 points) (Ott Review 6.35) Explain in terms of roots of the characteristic equation:
   (a) (5 points) the prompt jump phenomenon
   (b) (5 points) the delayed neutron induced transition
   (c) (5 points) the stable period
4. (30 points) (Ott Problem 8.1) Find the numerical value of p^{00}, the flux after a prompt jump for which the increase due to delayed neutrons is just compensated by Doppler feedback, for an LWR from the typical λ and γ/β values given in the text. Discuss why p^{00} may vary between reactors (e.g. the SEFOR reactor discussed in the text).
5. (15 points) (Ott Review 8.1) Define each term, give an example of the physical phenomena involved, and an example of a transient for each:
   (a) (5 points) Energy coefficient.
   (b) (5 points) Temperature coefficient. of reactvity.
   (c) (5 points) Power coeffciient.