

NERS551
Winter, 2022

HOMEWORK #3

Due: February 22, 2022

Chapter 8

1. Formulate the prompt jump approximation in words.
2. Derive the Prompt Jump Approximation (PJA) equation with one group of delayed neutrons, Eq. 8.10. Give a physical interpretation of each of the terms.
3. Explain for which type of transients PJA with one group delayed neutrons will be a good and a poor approximation compared to point kinetics with 6 delayed groups (use a sketch). (Hint: Use the example of a PWR steam line break and a PWR control rod ejection).

Chapter 10

4. **(Extra Credit Only)** In the SEFOR experiment, it was shown that the Doppler feedback coefficient could be measured indirectly using Eq. 10.49. Explain why the 0.945β curve must be used to estimate the Doppler feedback coefficient and find the numerical value of the flux after the prompt jump for an LWR, using values found in the text (and data below) for the case where the power increase due to delayed neutrons is cancelled by the effects of feedback.

Group	Isotope Independent λ (1/s)	β (ν_d/ν)
1	0.0129	0.0002
2	0.0311	0.0015
3	0.1340	0.0014
4	0.3310	0.0026
5	1.2600	0.0007
6	3.2100	0.0003
One Group (Beta-Weighted)	0.4392	0.0067

5. Chapter 10: Ott Homework Problem #4 (PKA for an LWR).

Parameter	Value
β	0.0075
Λ	1e-5
ρ_1	1.1\$
γ	-.8\$/fp-s