

22.312

ENGINEERING OF NUCLEAR REACTORS

Problem 12-15N

Thermal-hydraulic Analysis of a BWR Fuel Assembly

An 8×8 BWR fuel assembly has a flow area of 0.01 m^2 , is 3.6-m long and operates at the following conditions:

Pressure: 6.4 MPa
Mass flow rate: 16.5 kg/s
Inlet temperature: 270°C
Axially uniform heat flux

- 1) Assuming that neutron moderation requirements limit the void fraction at the outlet to 0.7, calculate the flow quality (x) at the outlet. (Assume a slip ratio of 1.8)
- 2) Assuming that at the outlet the equilibrium quality (x_e) is equal to the flow quality, calculate the fuel assembly power. Is $x_e=x$ a reasonable assumption in this case?
- 3) Calculate the axial location at which **saturated** boiling starts.
- 4) Calculate the Critical Power Ratio (CPR) for this fuel assembly, using the CISE-4 correlation for dry-out. (Assume L_b = distance from fuel assembly inlet; assume $D_e=D_h=13.5 \text{ mm}$)