Nuclear Thermal-Hydraulics

Problem Sheet I

1. Compute the Reynolds number for a 50mm id pipe carrying water at a rate of 0.05 m^3 per second. (14,038,000)

2. Compute the Reynolds number for a 500mm id duct carrying CO2 at a speed of 20 metres per second, at 900k and 4Mpa. (6.09e6)

3. What is meant by 'friction factor'?

4. What is the pressure drop in:-

(i) A 25mm id pipe, 100m long, carrying water at a rate of 3m^3 per hour? (93kPa)

(ii) A CO2 pipeline, 1.2m id, 2km long, moving at 20m /s at 300K, 40 bars. (Re=6.09e6, f = 0.009, dp=169e3Pa)

5. Determine the hydraulic diameter of a typical flow passage in a PWR, with pin od 0.009500, and a square pitch of 0. 0126m (0.011777m)

6. What is the pressure drop per unit length in passing up such a channel under the following conditions:

Channel mass flow 0.336 kg/s, (300K water props) (8.05e3 Pa m^{-1})

7. Determine the hydraulic diameter of the AGR coolant passage defined below.
Channel id = 0.1900 m
Clad od = 0.01525 m
36 pins in cross section.
(0.03752m)

8. Compute the frictional pressure drop in the AGR passage above, under the following conditions:

Friction factor 4 times that for a smooth tube

Passage flow rate 13.36 kg/s

Mean temperature in channel 750K

(Re 8.0203e+05, friction factor 0.0121, frictional pressure drop 7.2918+04 Pa)