KMÜ 427-21

TRANSPORT PHENOMENA

HOMEWORK 5 (Due January 27, 2020)

1. Heat is produced within a solid sphere with a radius of 0.20 cm with a heat conductivity of 36 W/m K. The amount of heat produced per unit volume and per unit time is given as

$$Q\ (W/m^3.s) = 1.8x10^{-3}\ T^{0.5}$$

Where T is the temperature (K). The surface temperature of the sphere is 110 ^oC.

a) Construct an enegy balance within the sphere.
b) Solve the energy balance with MATLAB to obtain the temperature profile within the sphere by appropriate assumptions.

2. A solution containing A at a concentration of 0.5 mol/L is fed into a tubular reactor with a volumetric flow rate of 1 L/min. The reaction rate constant is given as 0.2 m^3/mol. s. The reactor length and diameter are 3 m and 0.15 m, respectively. The reactor is operated under steady state conditions.

a) Perform a mass balance for reactant A.
b) Solve the mass balance with MATLAB to predict the concentration profile with appropriate assumptions.