CHG 3127 Tutorial Session 5 (2020-02-13)

A. The gas phase elementary reaction

$$A + 2B \rightarrow C + D$$

is carried out in an isothermal, isobaric plug flow reactor operated at 3.5 atm and 385 K and fed with a stoichiometric mix of reactants and an inert species I, where the mole fraction of the inert is 0.5. The rate constant with respect to A is 350 $dm^2/(mol^2\ s)$. The total volumetric flow rate entering the is 35.1 L/s at 112°C and 4.5 atm.

For a 20 L reactor, what is the expected conversion? Solve the problem using the design procedure based on fractional conversion analysis. Your solution should be accurate to within 0.001. Assume an initial maximum change of 0.03 in *X*.

B. For this part, repeat the problem in part A but use the design procedure based on molar flow rates, using the same step size as determined in **A**.

Recall: the concentration of any species i in the gas phase under isothermal and isobaric operation is given by

$$C_i = C_{T0}\frac{F_i}{F_T}$$

where

$$F_T = F_A + F_B + F_C + F_D + F_I$$