Reactor Design I: Tutorial 1. Reactor Systems

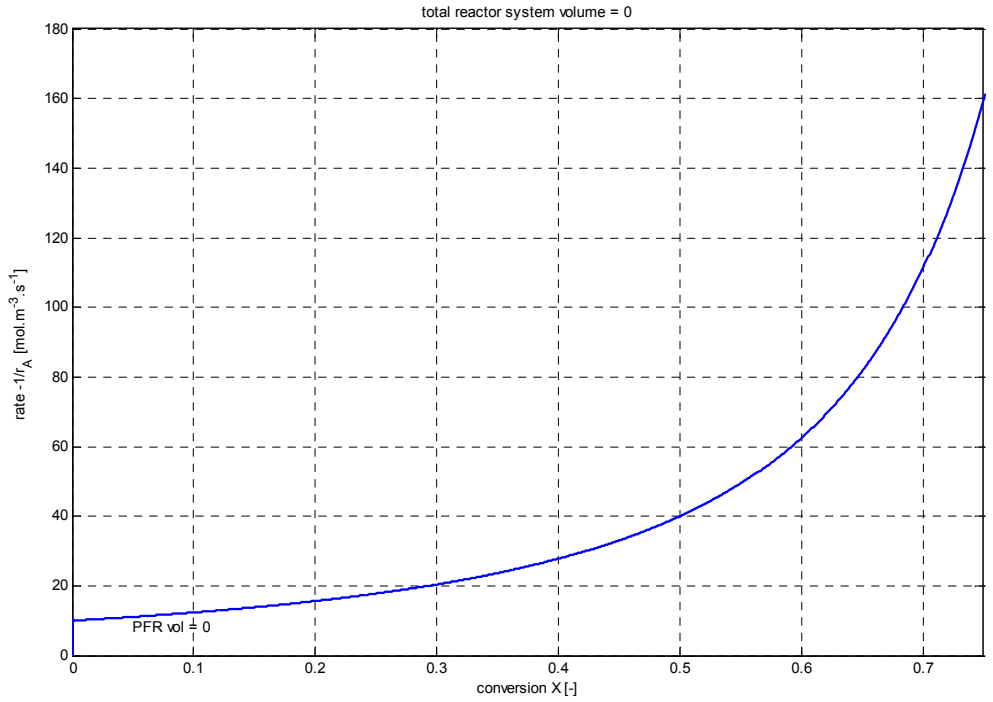
Department of Chemical Engineering, University of Cape Town
R Rawatlal, February 2006

Question 1

a) Relationship between DX and X
b) Develop the reactor design equation from first principles for the CSTR and PFR. Discuss how the reactor volume can be obtained from the $1/r_A$ vs X curve in each case.

Question 2

Consider the $1/r_A$ vs X curve shown in the figure given below:



What is the total reactor system volume required to achieve a final conversion of 70% for the following sets of reactors-in-series configurations:

a) one big CSTR
b) one big PFR
c) a CSTR followed by a PFR (intermediate conversion = 0.35)
d) a PFR followed by a CSTR (intermediate conversion = 0.35)
e) 4 CSTRs in series
f) 4 PFRs in series

Prepare your results in a table and discuss these results. If the reactors were in parallel, how would the results change?

Question 3

Develop an algorithm for determining the reaction rate constant and order of reaction for reactant A which disappears according to: $dC_A/dt = -kC_A^n$
Write matlab code that performs this search for a given data set $C_A(t)$