**MFR and PFR in Series**

Configuration A:

MFR --> PFR

Configuration B:

PFR --> MFR

For zero order, first order, second order reactions, which configuration has better conversion?

Zero Order:

No difference

First Order:

No difference

C0-C1/kC1 = τm

C1 = C0/1+kτm

ln(C1/C2) = τp

Kτp = ln(C1/C2)

C1/C2 = ekτp

C2 = C1/ekτp

C2 = C0/ekτp(1+kτm)

Second Order:

Configuration matters.

Solve for performance equations. Solve for intermediate concentration and outlet concentration one by one. Extent of reaction is present in solving for C2

**Two MFRs in Series**

Put smaller or larger first? Or does it matter?

Smaller first to minimize drop. Operates at outlet concentration. Stepwise job. Higher reaction, higher concentration, higher reaction rates.

**Mean Residence Time**

tbar = τ = ∫tCdt/∫Cdt

A = ∫Cdt

E = C/∫Cdt

**The Dispersion Model**

Pulse input, as passes through reactor, particles spread out throughout reactor

Depending on “craziness” of particles, dispersion may be large or small

What if reactor is PFR?

They come out at the same time (tau). They move at the same speed.

In reality: Reynold’s Number

Fick’s Law of Binary Diffusion

D/uVL = dimensionless group characterizing the spread in the whole vessel