PROBLEM: CSTR's

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if the standard graphical construction based on Figure 1 starting with C^*_1 not less than 0.85 (say) leads to a final value for C^*_N lower than required, then Eq. (16) can be used as a good approximation of Eq. (3). This approximation gets better as N increases and/or C^*_N increases and/or n decreases. If, on the other hand, the reverse graphical construction based on Figure 1 starting with C^*_N/C^*_{N-1} not greater than $[20(n-1)]^{-1/n}$ (say) leads to a final value for C^*_o larger than unity, then Eq. (5) can be used as a good approximation for $C^*_{1,opt}$ as obtained from Eq. (3). This approximation gets better as N decreases and/or C^*_N decreases and/or n increases.

NOMENCLATURE

- C = concentration of substrate, $mol \cdot m^{-3}$
- C_o = concentration of substrate at the inlet stream of the first reactor, $mol \cdot m^{-3}$
- C_i = concentration of substrate at the outlet stream of the ith reactor, $mol \cdot m^{-3}$
- C^*_i = normalized concentration of substrate at the outlet stream of the ith reactor
- $C^*_{i,opt}$ = normalized concentration of substrate at the outlet stream of the ith reactor leading to the minimum overall reactor volume
- Da_i = Damköhler number for the ith reactor, $(v_{max} \cdot V_i/Q \cdot C_o)$
- $Da_{i,min}$ = Damköhler number for the ith reactor leading to the minimum overall reactor volume, $(v_{max} \cdot V_{i,min}/Q \cdot C_o)$
- j = dummy integer variable for the summations
- K' = kinetic constant, $mol^n \cdot m^{-3n}$
- K^* = dimensionless kinetic constant, (K'/C_o^n)
- m = dummy integer variable for the summations
- n = apparent number of substrate binding sites per enzyme molecule
- N = total number of reactors in the series
- Q = volumetric flow rate through the reactor system, $m^3 \cdot s^{-1}$
- V_i = volume of the ith reactor, m^3
- $V_{i,min}$ = volume of the ith reactor leading to minimum overall reactor volume, m^3
- v = kinetic rate, $mol \cdot m^{-3} \cdot s^{-1}$
- v_{max} = maximum kinetic rate of the enzyme under study, $mol \cdot m^{-3} \cdot s^{-1}$

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