AFCoKaRE Practice Problem 24.1 Solution

Purpose: This problem will allow you to practice the quantitative analysis of multiple steady states in a CSTR.

Problem Statement: Suppose a steady state, 500 mL CSTR operates adiabatically at a space time of 0.4 min. The feed concentration is 5 M, and the feed temperature is 60 ºC. The fluid heat capacity is constant and equal to 1 cal mL^{-1} K^{-1}. In the reactor the feed, A, is converted to Z, reaction (1). The heat released by the reaction is 30 kcal mol^{-1}. The reaction rate is first order in A, equation (2), with a pre-exponential factor of 4.75×10^{13} min^{-1} and an activation energy of 25 kcal mol^{-1}. At these conditions, multiple steady states are possible. Determine the conversion of A for each steady state.

$$A \rightarrow Z \qquad (1)$$

$$r = kC_A \qquad (2)$$