$$
\begin{cases}
\dot{C_A}(t) & = \frac{q_0}{V} \cdot (C_{Af} - C_A(t)) - k_0 \cdot \exp\left(-\frac{E}{R \cdot T(t)}\right) \cdot C_A(t) \\
\dot{T}(t) & = \frac{q_0}{V} \cdot (T_f - T(t)) + \frac{(-\Delta H_r) \cdot k_0}{\rho \cdot C_p} \cdot \exp\left(-\frac{E}{R \cdot T(t)}\right) \cdot C_A(t) + \frac{UA}{V \cdot \rho \cdot C_p} \cdot (T_c(t) - T(t)) \\
\dot{T_c}(t) & = \frac{T_r(t) - T_c(t)}{\tau_c}
\end{cases} \tag{1}
$$

$$
\overline{x} = \begin{cases}
\overline{C}_A & = 0.5054 \\
\overline{T} & = 315.5491 \\
\overline{T}_c & = 308
\end{cases} \tag{2}
$$

$$
0 = \frac{\overline{T}_r - \overline{T}_c}{\tau_c} = \frac{\overline{T}_r - 308}{\tau_c} \tag{3}
$$

$\overline{u} = \overline{T}_r = 308$

$$
\begin{cases}
\delta \dot{x}(t) & \simeq f_x(\overline{x}, \overline{u}) \delta x(t) + f_u(\overline{x}, \overline{u}) \delta u(t) \\
\delta y(t) & \simeq g_x(\overline{x}, \overline{u}) \delta x(t) + g_u(\overline{x}, \overline{u}) \delta u(t)
\end{cases} \tag{4}
$$

$$
f_x(\overline{x}, \overline{u}) = A = \begin{bmatrix}
\frac{\delta f_1}{\delta x_1} & \frac{\delta f_1}{\delta x_2} & \frac{\delta f_1}{\delta x_3} \\
\frac{\delta f_2}{\delta x_1} & \frac{\delta f_2}{\delta x_2} & \frac{\delta f_2}{\delta x_3} \\
\frac{\delta f_3}{\delta x_1} & \frac{\delta f_3}{\delta x_2} & \frac{\delta f_3}{\delta x_3}
\end{bmatrix}_{\substack{x = \overline{x} \\ u = \overline{u}}} \tag{5}
$$

$$
f_u(\overline{x}, \overline{u}) = B = \begin{bmatrix}
\frac{\delta f_1}{\delta u} \\
\frac{\delta f_2}{\delta u} \\
\frac{\delta f_3}{\delta u}
\end{bmatrix}_{\substack{x = \overline{x} \\ u = \overline{u}}} \tag{6}
$$

$$
g_x(\overline{x}, \overline{u}) = C = \begin{bmatrix} \frac{\delta g}{\delta x_1} & \frac{\delta g}{\delta x_2} & \frac{\delta g}{\delta x_3} \end{bmatrix}_{\substack{x = \overline{x} \\ u = \overline{u}}} \tag{7}
$$

$g_u(\overline{x}, \overline{u}) = D = \left. \frac{\delta g}{\delta u} \right|_{\substack{x = \overline{x} \\ u = \overline{u}}}$

$$
\begin{cases}
\dot{C_A}(t) & = \frac{q_0}{V} \cdot (C_{Af} - C_A(t)) - k_0 \cdot \exp\left(-\frac{E}{R \cdot T(t)}\right) \cdot C_A(t) \\
\dot{T}(t) & = \frac{q_0}{V} \cdot (T_f - T(t)) + \frac{(-\Delta H_r) \cdot k_0}{\rho \cdot C_p} \cdot \exp\left(-\frac{E}{R \cdot T(t)}\right) \cdot C_A(t) + \frac{UA}{V \cdot \rho \cdot C_p} \cdot (T_c(t) - T(t)) \\
\dot{T_c}(t) & = \frac{T_r(t) - T_c(t)}{\tau_c} \\
y(t) & = C_A(t)
\end{cases} \tag{8}
$$

$$
A = \begin{bmatrix}
-k_0 \cdot \exp\left(\frac{-E}{R \cdot \overline{T}}\right) - \frac{q_0}{V} & -\frac{T_c \cdot E \cdot k_0}{R} \exp\left(\frac{-E}{R \cdot \overline{T}}\right) \cdot \frac{1}{\overline{T}^2} & 0 \\
\frac{-\Delta H_r \cdot k_0}{\rho C_p} \cdot \exp\left(\frac{-E}{R \cdot \overline{T}}\right) & -\frac{q_0}{V} + (\frac{\overline{C}_A \cdot (-\Delta H_r) \cdot k_0}{\rho \cdot C_p} \exp\left(\frac{E}{R \cdot \overline{T}}\right) \cdot \frac{E}{R \cdot \overline{T}^2}) - \frac{UA}{V \cdot \rho \cdot C_p} & \frac{UA}{V \cdot \rho \cdot C_p} \\
0 & 0 & -\frac{1}{\tau_c}
\end{bmatrix} \tag{9}
$$

$$B = \begin{bmatrix} 0 \\ 0 \\ \frac{1}{\tau_c} \end{bmatrix}$$

$$C = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$$

$$D = 0$$