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APÊNDICE

Encontrando o modelo em espaços de estado da forma:

$$\begin{cases} \dot{\tilde{x}} = \tilde{A}\,\underline{x} + \tilde{B}\,\underline{u} + \Gamma\,\underline{d} \\ \tilde{y} = \tilde{C}\,\underline{x} \end{cases}$$

Então para o caso do reator de Van de Vusse:

$$A = \begin{bmatrix} \partial f_1/\partial C_A|_{EE} & \partial f_1/\partial C_B|_{EE} & \partial f_1/\partial T|_{EE} \\ \partial f_2/\partial C_A|_{EE} & \partial f_2/\partial C_B|_{EE} & \partial f_2/\partial T|_{EE} \\ \partial f_3/\partial C_A|_{EE} & \partial f_3/\partial C_B|_{EE} & \partial f_3/\partial T|_{EE} \end{bmatrix}$$

Em que: $\frac{dC_A}{dt} = f_1$; $\frac{dC_B}{dt} = f_2$ e $\frac{dT}{dt} = f_3$

E o subscripto E corresponde ao valor no EE:

$$\left.\frac{\partial f_1}{\partial C_A}\right|_{EE} = -\frac{F_e}{V} - K_1(T_E) - 2C_{A,e}K_3(T_E)$$

$$\left.\frac{\partial f_1}{\partial C_B}\right|_{EE} = 0$$

$$\left.\frac{\partial f_1}{\partial T}\right|_{EE} = -\frac{E_1 K_1(T_E)\,C_{AE}}{R\,(T_E+273.15)^2} - \frac{E_3 K_3(T_E)\,C_{AE}^2}{R\,(T_E+273.15)^2}$$

$$\left.\frac{\partial f_2}{\partial C_A}\right|_{EE} = K_1(T_E)$$

$$\left.\frac{\partial f_2}{\partial C_B}\right|_{EE} = -\frac{F_e}{V} - K_2(T_E)$$

$$\left.\frac{\partial f_2}{\partial T}\right|_{EE} = \frac{-E_2 K_2(T_E) C_B}{R(T+273.15)^2}$$

$$\left.\frac{\partial f_3}{\partial C_A}\right|_{EE} = \frac{1}{\rho C_p}\left[K_1(T_E)(-\Delta H_{RAB}) + 2C_{AE} K_3(T_E)(-\Delta H_{RAD})\right]$$

$$\left.\frac{\partial f_3}{\partial C_B}\right|_{EE} = \frac{1}{\rho C_p}\left[K_2(T_E)(-\Delta H_{RBC})\right]$$

$$\left.\frac{\partial f_3}{\partial T}\right|_{EE} = \frac{1}{\rho C_p}\left[\frac{(-\Delta H_{RAB}) K_1(T_E) C_{AE} E_1}{R(T+273.15)^2} + \right.$$

$$\left. + \frac{(-\Delta H_{RBC}) K_2(T_E) C_{BE} E_2}{R(T+273.15)^2} + \frac{(-\Delta H_{RAD}) K_3(T_E) C_{AE}^2 E_3}{R(T+273.15)^2}\right] +$$

$$-\frac{F_e}{V} - \frac{K_W A_R}{\rho C_p V}$$

Matriz B, considerando $\frac{F}{V} = fv$

$$B = \begin{bmatrix} \partial f_1 / \partial fv|_{EE} & \partial f_1 / T_K|_{EE} \\ \partial f_2 / \partial fv|_{EE} & \partial f_2 / T_K|_{EE} \\ \partial f_3 / \partial fv|_{EE} & \partial f_3 / T_K|_{EE} \end{bmatrix}$$

$$\left.\frac{\partial f_1}{\partial fv}\right|_{EE} = C_{A0} - C_{AE} \;;\; \left.\frac{\partial f_1}{\partial T_K}\right|_{EE} = 0$$

$$\left.\frac{\partial f_2}{\partial fv}\right|_{EE} = -C_{BE} \;,\; \left.\frac{\partial f_2}{\partial T_K}\right|_{EE} = 0$$

$$\left.\frac{\partial f_3}{\partial fv}\right|_{EE} = T_0 - T_E \;,\; \left.\frac{\partial f_3}{\partial T_K}\right|_{EE} = \frac{K_w A_R}{\rho C_p V}$$