15-4

$A + B \Rightarrow C + D$

vsádkový r

$T_0 = 313\,K$

$c_{A0} = 2{,}4\ kmol/m^3$

$\Delta_R h = -167{,}6\ kJ/kmol$

$\varrho = 960\ kg/m^3$

$\langle c_p \rangle = 2{,}09\ kJ/kg \cdot K$

$\xi_A = 40\%$

$t = 4{,}7\ h$

$[T = ?\quad T < 373\,K\ ??]$

$$\frac{dm_A}{dt} = -r \cdot V$$

$$\frac{dH}{dt} = 0$$

$$\frac{d\tilde{H}}{d\xi} = -\Delta_R h \cdot r V$$

$$c_p V \varrho \frac{dT}{dt} = -\Delta_R h \cdot r \cdot V$$

$$\frac{dc_A}{dt} = -r$$

$$c_p \varrho \frac{dT}{dt} = -\Delta_R h \cdot r$$

$$\frac{dT}{dc_A} = +\frac{\Delta_R h}{\varrho c_p} \qquad \frac{J/mol}{\frac{kg}{m^3}\,\frac{J}{kg \cdot K}}$$

$$\int_{T_0}^{T} dT = \int_{c_{A0}}^{c_A} dc_A \cdot \frac{\Delta_R h}{\varrho c_p}$$

$$T - T_0 = \frac{\Delta_R h}{\varrho c_p} \cdot (c_A - c_{A0})$$

$$= \frac{-167{,}6\ kJ/kmol}{10^3}$$

NEODVOZOVAT / BLOUHE!

$$H = \sum n_i h_i$$

$$h_i = \Delta_F h_i + \langle c_{p,i} \rangle (T - 25°C)$$

$$n_i = n_{i0} + \nu_i \xi$$

$$H = \underline{\sum n_{i0} \Delta_F h_i} + \sum n_{i0} \langle c_{p,i} \rangle (T - 25°C) + \underline{\sum \nu_i \xi \Delta_F h_i} + \sum \nu_i \xi \cdot \langle c_{p,i} \rangle (T - 25°C)$$

$$H = \xi \cdot \underbrace{\left\{ \sum \nu_i \Delta_F h_i + \sum \nu_i c_{p,i} \rangle (T - 25°C) \right\}}_{\Delta_R h(T)} + \sum n_{i0} \left\{ \Delta_F h_i + \langle c_{p,i} \rangle (T - 25°C) \right\}$$

$$\frac{dH}{dt} = \frac{d\xi}{dt} \cdot \Delta_R h(T) + 0 + \underbrace{\left[\sum n_{i0} c_{p,i} \right]}_{m \cdot c_p^{mix}} \frac{dT}{dt}$$

restart:

U15-04 vsadkovy reaktor s ent. bilanci (integralne, bez derivaci)

> $T0 := 313 : \# K$

$cA0 := 2.4 : \# \frac{kmol}{m^3}$

$dRh := -167.6e3 : \# \frac{kJ}{kmol}$

$\mathrm{rho} := 960 : \# \frac{kg}{m^3}$

$Cp := 2.09 : \# \frac{kJ}{kg \cdot K}$

$dzeta\_A := 0.40 : \#\ 40\%\ konverze$

Vysledna koncentrace

> $cA := cA0 \cdot (1 - dzeta\_A); \# \frac{kmol}{m^3}$

$$cA := 1.440 \quad (1)$$

Vysledna teplota adiabatickeho reaktoru

> $delta\_T := \frac{dRh}{\mathrm{rho} \cdot Cp} \cdot (cA - cA0); \#\ C\ nebo\ K$

$$delta\_T := 80.19138755 \quad (2)$$

$T := T0 + delta\_T; \# K$

$$T := 393.1913876 \quad (3)$$