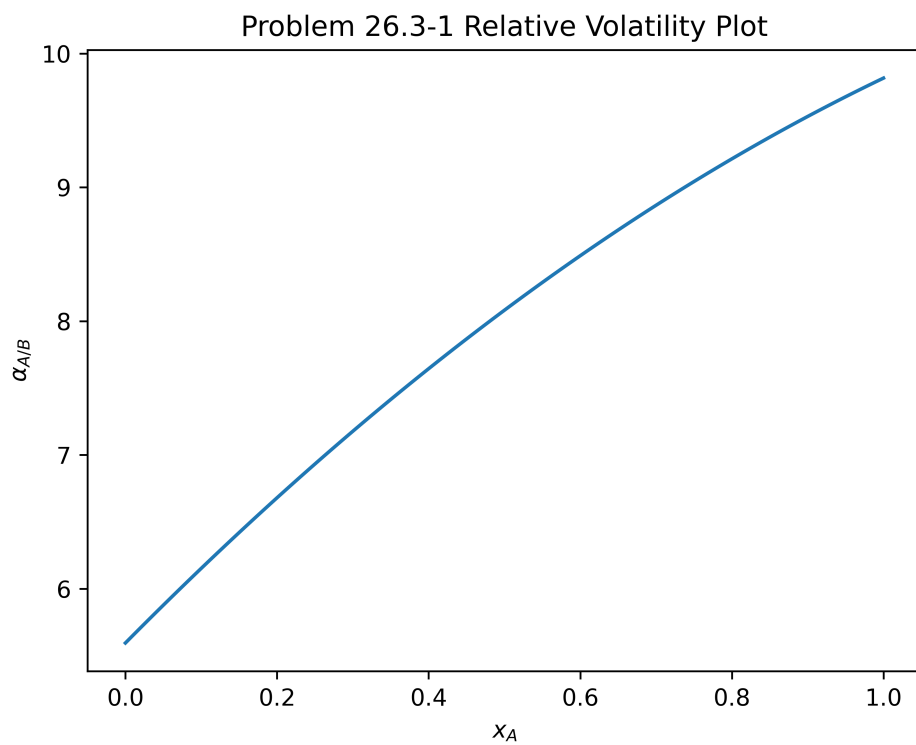


1. Problem 26.3-1

$$\alpha_{A/B} = \frac{\left(\frac{y_A}{x_A}\right)}{\left(\frac{y_B}{x_B}\right)} = \frac{\left(\frac{y_A}{x_A}\right)}{\left(\frac{1-y_A}{1-x_A}\right)}$$

Plot with data from Example 26.3-2:



2. Problem 26.3-2

(a)

Fit equilibrium data from Example 26.3-2 to 4th order polynomial.

$$y(x) = -3.806x^4 + 10.185x^3 - 10.141x^2 + 4.749x + 0.0101$$

$$\ln \left(\frac{L_1}{L_2} \right) = \int_{x_2}^{x_1} \frac{dx}{y - x}$$

$$L_1 = 100$$

$$x_1 = 0.6$$

By mass balance

$$L_2 = 60$$

$$0 = \int_{x_2}^{0.6} \frac{dx}{-3.806x^4 + 10.185x^3 - 10.141x^2 + 4.749x + 0.0101 - x} - \ln \left(\frac{100}{60} \right)$$

Solve for x_2

$$\boxed{x_2 = 0.407}$$

Material balance for A

$$L_1 x_1 = L_2 x_2 + D y_{avg}$$

$$100 \cdot 0.6 = 60 \cdot 0.407 + 40 y_{avg}$$

$$\boxed{y_{avg} = 0.889}$$

(b)

Flash material balance

$$F x_F = D y_D + W x_W$$

$$y_D = -3.806x_W^4 + 10.185x_W^3 - 10.141x_W^2 + 4.749x_W + 0.0101$$

$$100 \cdot 0.6 = 40 \left(-3.806x_W^4 + 10.185x_W^3 - 10.141x_W^2 + 4.749x_W + 0.0101 \right) + 60x_W$$

Solve for x_W

$$\boxed{x_W = 0.429}$$

$$y_D = f(0.429)$$

$$\boxed{y_D = 0.856}$$

3. Problem 26.3-3

Fit equilibrium data from Table 26.1-1 to 4th order polynomial.

$$\begin{aligned}y(x) &= -0.417x^4 + 1.493x^3 - 2.361x^2 + 2.285x \\ \ln\left(\frac{L_1}{L_2}\right) &= \int_{x_2}^{x_1} \frac{dx}{y-x} \\ L_1 &= 100 \\ x_1 &= 0.7\end{aligned}$$

By mass balance

$$\begin{aligned}L_2 &= 66.7 \\ 0 &= \int_{x_2}^{0.7} \frac{dx}{-0.417x^4 + 1.493x^3 - 2.361x^2 + 2.285x - x} - \ln\left(\frac{100}{66.7}\right)\end{aligned}$$

Solve for x_2

$$\boxed{x_2 = 0.632}$$

Material balance for A

$$\begin{aligned}L_1x_1 &= L_2x_2 + Dy_{avg} \\ 100 \cdot 0.7 &= 66.7 \cdot 0.632 + 33.3y_{avg} \\ \boxed{y_{avg} &= 0.836}\end{aligned}$$

4. Problem 26.4-3

Use equilibrium data from Table 26.1-1

(a)

$$y(x) = -0.417x^4 + 1.493x^3 - 2.361x^2 + 2.285x$$

$$x' = 0.5$$

$$y' = y(x')$$

$$y' = 0.713$$

$$R_m = \frac{y_D - y'}{y' - x'}$$

$$y_D = 0.9$$

$$m = \frac{0.9 - 0.713}{0.9 - 0.5}$$

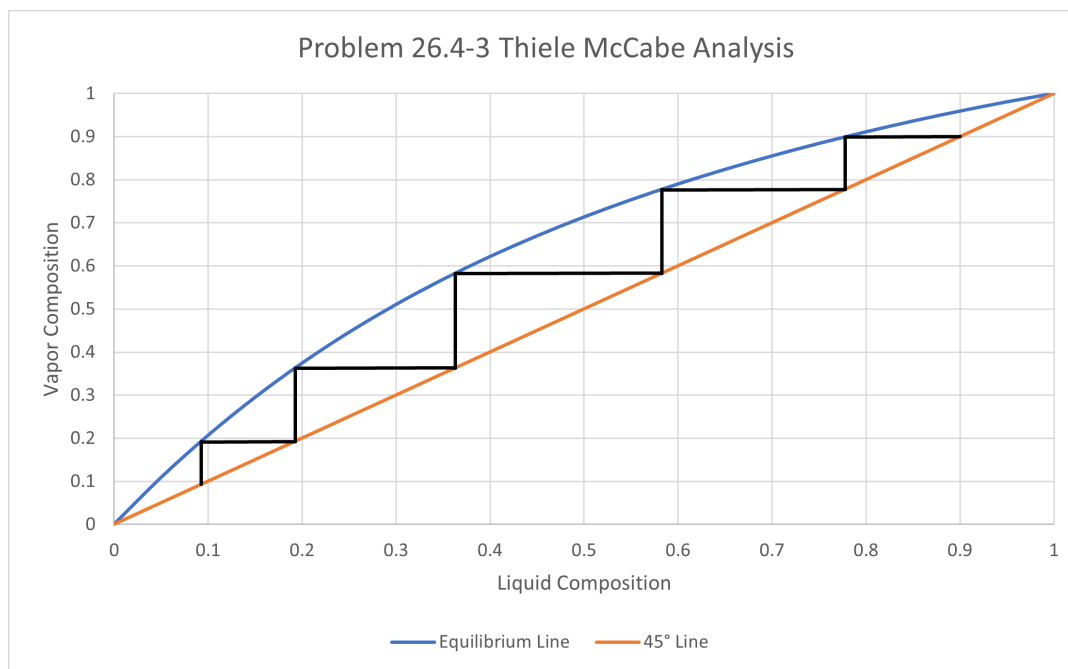
$$m = 0.46$$

$$R_m = \frac{m}{1 - m}$$

$$R_m = \frac{0.46}{1 - 0.46}$$

$$R_m = 0.876$$

(b) Plot equilibrium line and 45° line. The operating lines are parallel to the 45° line at infinite reflux.



The total number of stages is 5. The minimum number of trays is 4 plus a reboiler.