$ORIGIN := 1$

$T := 263$ $\quad x := \begin{pmatrix} 0.204 \\ 1 - 0.204 \end{pmatrix}$

$T_c := \begin{pmatrix} 282.5 \\ 304.2 \end{pmatrix}$ $\quad P_c := \begin{pmatrix} 50.6 \\ 73.8 \end{pmatrix}$ $\quad \omega := \begin{pmatrix} 0.089 \\ 0.239 \end{pmatrix}$ $\quad k := \begin{pmatrix} 0 & 0.055 \\ 0.055 & 0 \end{pmatrix}$

$P_1 := 30.68$ $\quad P_2 := 26.66$

$$root(p, q, r) := \left| \begin{array}{l} v \leftarrow \begin{pmatrix} r \\ q \\ p \\ 1 \end{pmatrix} \\ x \leftarrow polyroots(v) \\ \text{for } i \in 1 .. 3 \\ \quad x_i \leftarrow 0 \text{ if } Im(x_i) \neq 0 \\ x1 \leftarrow max(x) \\ y \leftarrow min(x) \\ x2 \leftarrow \left| \begin{array}{ll} max(x) & \text{if } y = 0 \\ y & \text{otherwise} \end{array} \right. \\ \begin{pmatrix} x1 \\ x2 \end{pmatrix} \end{array} \right.$$

$$\phi_V(y, P) :=$$

$n \leftarrow 2$

for $i \in 1 .. n$

$T_{r_i} \leftarrow \frac{T}{T_{c_i}}$

$P_{r_i} \leftarrow \frac{P}{P_{c_i}}$

$\alpha_i \leftarrow \left[1 + \left[0.37464 + 1.54226 \cdot \omega_i - 0.26992 \cdot (\omega_i)^2\right] \cdot \left(1 - \sqrt{T_{r_i}}\right)\right]^2$

$A_{i,i} \leftarrow 0.45724 \cdot \left[\frac{P_{r_i}}{(T_{r_i})^2}\right] \cdot \alpha_i$

$B_i \leftarrow 0.07780 \cdot \left(\frac{P_{r_i}}{T_{r_i}}\right)$

for $i \in 1 .. n$

for $j \in 1 .. n$

$A_{i,j} \leftarrow (1 - k_{i,j}) \cdot \sqrt{A_{i,i} \cdot A_{j,j}}$

$A_{mix} \leftarrow \sum_{i=1}^{n} \sum_{j=1}^{n} (y_i \cdot y_j \cdot A_{i,j})$

$B_{mix} \leftarrow \sum_{i=1}^{n} (y_i \cdot B_i)$

$p \leftarrow -1 + B_{mix}$

$q \leftarrow A_{mix} - 2 \cdot B_{mix} - 3 \cdot B_{mix}^2$

$r \leftarrow -A_{mix} \cdot B_{mix} + B_{mix}^2 + B_{mix}^3$

$Z \leftarrow \text{root}(p, q, r)_1$

$C \leftarrow \ln\left[\frac{Z + (1 + \sqrt{2}) \cdot B_{mix}}{Z + (1 - \sqrt{2}) \cdot B_{mix}}\right]$

for $i \in 1 .. n$

$\phi_i \leftarrow \exp\left[\frac{B_i \cdot (Z - 1)}{B_{mix}} - \ln(Z - B_{mix}) - \frac{A_{mix} \cdot C}{2\sqrt{2} \cdot B_{mix}} \cdot \left[\frac{2 \cdot \sum_{j=1}^{n} (y_j \cdot A_{i,j})}{A_{mix}} - \frac{B_i}{B_{mix}}\right]\right]$

ϕ

$\phi_L(P) :=$

$n \leftarrow 2$

for $i \in 1 .. n$

$T_{r_i} \leftarrow \frac{T}{T_{c_i}}$

$P_{r_i} \leftarrow \frac{P}{P_{c_i}}$

$\alpha_i \leftarrow \left[1 + \left[0.37464 + 1.54226 \cdot \omega_i - 0.26992 \cdot (\omega_i)^2\right] \cdot \left(1 - \sqrt{T_{r_i}}\right)\right]^2$

$A_{i,i} \leftarrow 0.45724 \cdot \left[\frac{P_{r_i}}{(T_{r_i})^2}\right] \cdot \alpha_i$

$B_i \leftarrow 0.07780 \cdot \left(\frac{P_{r_i}}{T_{r_i}}\right)$

for $i \in 1 .. n$

for $j \in 1 .. n$

$A_{i,j} \leftarrow (1 - k_{i,j}) \cdot \sqrt{A_{i,i} \cdot A_{j,j}}$

$A_{mix} \leftarrow \sum_{i=1}^{n} \sum_{j=1}^{n} (x_i \cdot x_j \cdot A_{i,j})$

$B_{mix} \leftarrow \sum_{i=1}^{n} (x_i \cdot B_i)$

$p \leftarrow -1 + B_{mix}$

$q \leftarrow A_{mix} - 2 \cdot B_{mix} - 3 \cdot B_{mix}^2$

$r \leftarrow -A_{mix} \cdot B_{mix} + B_{mix}^2 + B_{mix}^3$

$Z \leftarrow \text{root}(p, q, r)_2$

$C \leftarrow \ln\left[\frac{Z + (1 + \sqrt{2}) \cdot B_{mix}}{Z + (1 - \sqrt{2}) \cdot B_{mix}}\right]$

for $i \in 1 .. n$

$\phi \leftarrow \exp\left[B_i \cdot (Z - 1) \quad \ln(Z - B_{mix}) \quad A_{mix} \cdot C \left[2 \cdot \sum_{j=1}^{n} (x_j \cdot A_{i,j}) \quad B_i\right]\right]$

$$\left| \phi_i \leftarrow \exp\left[\frac{B_{mix}}{B_{mix}} - \ln(Z - B_{mix}) - \frac{A_{mix}}{2\sqrt{2}\cdot B_{mix}} \cdot \left[\frac{A_{mix}}{B_{mix}} - \frac{B_{mix}}{B_{mix}} \right] \right] \right.$$

ϕ

$P := P_1 \cdot x_1 + P_2 \cdot x_2 = 27.48$

$y_1 := \frac{P_1 \cdot x_1}{P} = 0.228$

$y_2 := 1 - y_1 = 0.772$

Given

$y_1 \cdot \phi_V(y, P)_1 = x_1 \cdot \phi_L(P)_1$

$y_2 \cdot \phi_V(y, P)_2 = x_2 \cdot \phi_L(P)_2$

$y_1 + y_2 = 1$

$\begin{pmatrix} P \\ y \end{pmatrix} := \text{Find}(P, y)$

$P = 30.417$ $\quad y = \begin{pmatrix} 0.268 \\ 0.732 \end{pmatrix}$