Peng–Robinson-Stryjek-Vera (PRSV) EOS @model

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One of the cubic equations of real gas state defining the Compressibility factor $Z(p, T)$ as a function of fluid pressure p and fluid temperature T:

(1) $Z^3 - (1-B)\, Z^2 + (A - 2B - 3B^2)\, Z - (AB - B^2 - B^3) = 0$	
(2) $A = 0.45724 \cdot \alpha \cdot \frac{p_r}{T_r^2}$	(3) $B = 0.07780 \cdot \frac{p_r}{T_r}$
(4) $\alpha = \left(1 + \kappa\,(1 - T_r^{0.5})\right)^2$	(5) $\kappa = \kappa_0 + \left[\kappa_1 + \kappa_2(\kappa_3 - T_r)(1 - T_r^{0.5})\right]\,(1 + T_r^{0.5})\,(0.7 - T_r)$
	(6) $\kappa_0 = 0.378893 + 1.4897153\,\omega - 0.17131848\,\omega^2 + 0.0196554\,\omega^3$

where

Z	Compressibility factor	p_c	Critical pressure
p	Fluid pressure	T_c	ritical temperature
T	Fluid temperature	$p_r = p/p_c$	Reduced pressure
R	Gas constant	$T_r = T/T_c$	Reduced temperature
ω	Acentric factor	$\{\kappa_1, \kappa_2, \kappa_3\}$	fitting parameters

Once compressibility Z-factor $Z(p, T)$ is known the fluid density ρ can be calculated as:

(7) $$\rho(p, T) = \frac{1}{Z(p,T)} \cdot \frac{M}{R} \cdot \frac{p}{T}$$

where

M	fluid molar mass

See also

Natural Science / Physics / Thermodynamics / Equation of State / Real Gas EOS @model

[Real Gas]