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a solution with two a & b endmembers that do not interact (except entropic terms)
xa and xb are the mole fractions; va and vb, the molar volumes; vfa and vfb are the volume fractions.

> $V := xa \cdot va(P) + xb \cdot vb(P);$

$$V := xa\ va(P) + xb\ vb(P) \tag{1}$$

> $dpdv := \frac{1}{diff(V, P)};$

$$dpdv := \frac{1}{xa\left(\frac{d}{dP}\ va(P)\right) + xb\left(\frac{d}{dP}\ vb(P)\right)} \tag{2}$$

> $K := -dpdv \cdot V;$

$$K := -\frac{xa\ va(P) + xb\ vb(P)}{xa\left(\frac{d}{dP}\ va(P)\right) + xb\left(\frac{d}{dP}\ vb(P)\right)} \tag{3}$$

> $simplify(K);$

$$\frac{-xa\ va(P) - xb\ vb(P)}{xa\left(\frac{d}{dP}\ va(P)\right) + xb\left(\frac{d}{dP}\ vb(P)\right)} \tag{4}$$

> $K1 := subs\left(diff(va(P), P) = -\frac{va(P)}{Ka}, diff(vb(P), P) = -\frac{vb(P)}{Kb}, K\right)$

$$K1 := -\frac{xa\ va(P) + xb\ vb(P)}{-\frac{xa\ va(P)}{Ka} - \frac{xb\ vb(P)}{Kb}} \tag{5}$$

> $simplify(K1)$

$$\frac{(xa\ va(P) + xb\ vb(P))\ Ka\ Kb}{xb\ vb(P)\ Ka + xa\ va(P)\ Kb} \tag{6}$$

> $vfa := \frac{xa \cdot va(P)}{V}$

$$vfa := \frac{xa\ va(P)}{xa\ va(P) + xb\ vb(P)} \tag{7}$$

> $vfb := \frac{xb \cdot vb(P)}{V}$

$$vfb := \frac{xb\ vb(P)}{xa\ va(P) + xb\ vb(P)} \tag{8}$$

> $reuss := \left(\frac{vfa}{Ka} + \frac{vfb}{Kb}\right)^{-1}$

$$reuss := \frac{1}{\frac{xa\ va(P)}{(xa\ va(P) + xb\ vb(P))\ Ka} + \frac{xb\ vb(P)}{(xa\ va(P) + xb\ vb(P))\ Kb}} \tag{9}$$

> $simplify(reuss - K1);$

$$0 \tag{10}$$

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