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Bridgman Tables
Examples of how to use the Bridgman Tables

1. For example, we want to calculate the change in entropy for an isothermal expansion. Then we want $\left(\frac{\partial S}{\partial V}\right)_T$.

Assume we have a pressure explicit equation of state. Since temperature is constant, we go to the Temperature Section (Section II.) of the volume explicit equation of state Tables. There, we find:

1. $(\partial V)_T = -(\partial T)_V = -1$

3. $(\partial S)_T = -(\partial T)_S = -\left(\frac{\partial p}{\partial T}\right)_V$

So our derivative is

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{(\partial S)_T}{(\partial V)_T} = \frac{-\left(\frac{\partial p}{\partial T}\right)_V}{-1} = \left(\frac{\partial p}{\partial T}\right)_V$$

So, for example, if our particular pressure-explicit equation of state is the van der Waal's equation of state, then we have:

$$P = \frac{RT}{V-b} - \frac{a}{V^2}$$

$$\left(\frac{\partial p}{\partial T}\right)_V = \left(\frac{\partial\left(\frac{RT}{V-b} - \frac{a}{V^2}\right)}{\partial T}\right)_V = \frac{R}{V-b}$$

so the entropy change due to an isothermal expansion of a van der Waal's gas is

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{R}{V-b}$$

2. We again want to calculate the change in entropy for an isothermal expansion, $\left(\frac{\partial S}{\partial V}\right)_T$.

Assume we have a volume explicit equation of state. Since temperature is constant, we go to the Temperature Section (Section II.) of the volume explicit equation of state Tables. There, we find:

1. $(\partial V)_T = -(\partial T)_V = -\left(\frac{\partial V}{\partial p}\right)_T$

3. $(\partial S)_T = -(\partial T)_S = \left(\frac{\partial V}{\partial T}\right)_p$

So our derivative is

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{(\partial S)_T}{(\partial V)_T} = \frac{\left(\frac{\partial V}{\partial T}\right)_p}{-\left(\frac{\partial V}{\partial p}\right)_T}$$

So, for example, if our particular volume-explicit equation of state is the volume-explicit virial equation of state , truncated after three terms:

$$V = \frac{T}{P}\left(R + \frac{B}{P} + \frac{C}{P^2}\right)$$

$$\left(\frac{\partial V}{\partial T}\right)_p = \frac{1}{P}\left(R + \frac{B}{P} + \frac{C}{P^2}\right)$$

$$\left(\frac{\partial V}{\partial p}\right)_T = -T\left(\frac{R}{P^2} + 2\frac{B}{P^3} + 3\frac{C}{P^4}\right)$$

$$\left(\frac{\partial S}{\partial V}\right)_T = \frac{\frac{1}{P}\left(R + \frac{B}{P} + \frac{C}{P^2}\right)}{T\left(\frac{R}{P^2} + 2\frac{B}{P^3} + 3\frac{C}{P^4}\right)}$$