Common tangent procedure

Saturday 9$^{\text{th}}$ June, 2018

1 Introduction

Given two energy-volume curves corresponding to calcite I and II fitted to a cubic fit:

$$f_1(x_1) = a_0 + a_1x_1 + a_2x_1^2 + a_3x_1^3 \tag{1}$$

$$f_2(x_2) = a_4 + a_5x_2 + a_6x_1^2 + a_7x_1^3 \tag{2}$$

Where the first dertivative is:

$$f_1'(x_1) = a_1 + 2a_2x_1 + 3a_3x_1^2 \tag{3}$$

$$f_2'(x_2) = a_5 + 2a_6x_2 + 3a_7x_2^2 \tag{4}$$

It is satisfied that m, the slope of the common tangent is:

$$m = \frac{f_1(x_1) - f_2(x_2)}{x_1 - x_2} = f_1'(x_1) = f_2'(x_2) \tag{5}$$

We can write down a system of two equations:

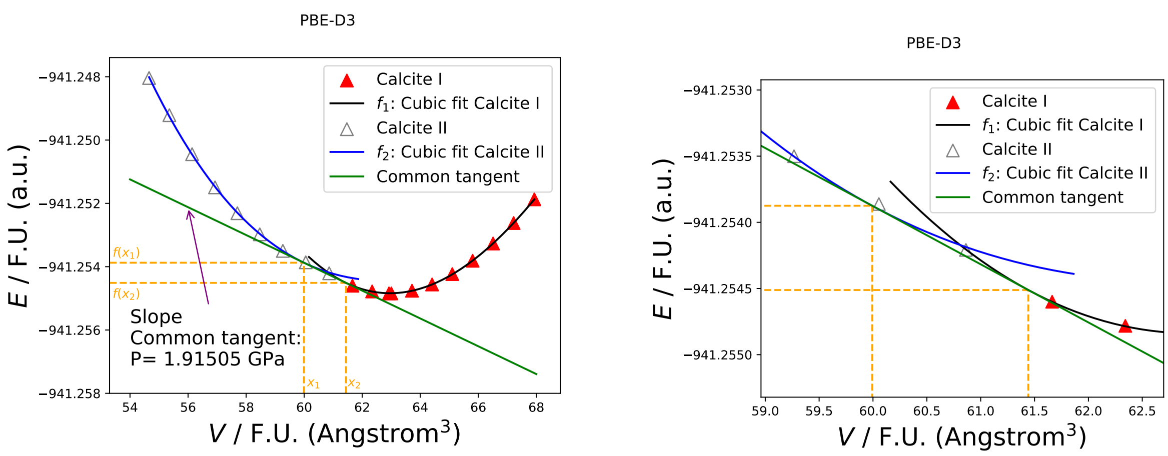
$$\frac{f_1(x_1) - f_2(x_2)}{x_1 - x_2} - f_1'(x_1) = 0 \tag{6}$$

$$f_1'(x_1) - f_2'(x_2) = 0 \tag{7}$$

The equation of the common tangent reads like:

$$y - f_1(x_1) = m(x - x_1)$$

$$\boxed{y = f_1(x_1) + m(x - x_1)} \tag{8}$$



(a) Picture 1 **(b)** Picture 2

Because $f_1(x_1)$ and $f_2(x_2)$ depend only on x_1 and x_2, the system of equations based on Eqns (6) and (7), contain two unknowns, x_1 and x_2. Once obtained x_1 and x_2, m can be obtained as Eq. 5. Once reached this point, we can then go to Eq. 8 and sort out the common tangent equation

References