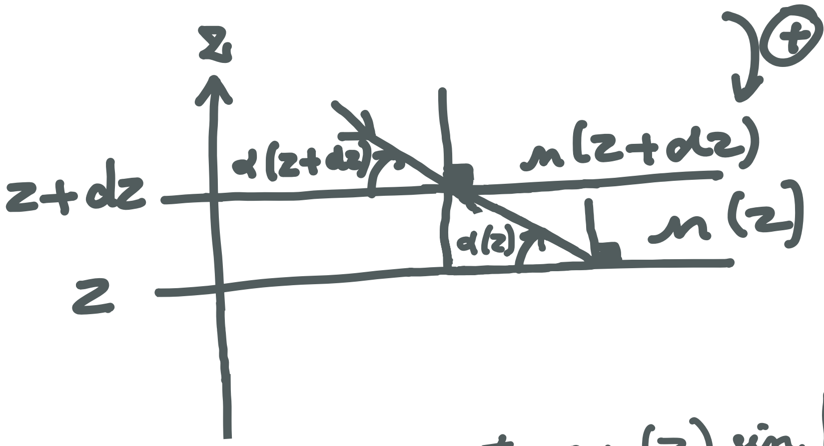


1) Loi de Descartes : $n(z)\sin\left[\frac{\pi}{2}-\alpha(z)\right]$

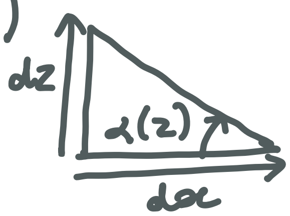
$= n(z+dz)\sin\left[\frac{\pi}{2}-\alpha(z+dz)\right]$

$= \underline{cte}$

$\Rightarrow n(z)\cos[\alpha(z)] = n(z+dz)\cos[\alpha(z+dz)] = A$

(C.L : $A = \cos(\alpha_0)\, n_0$

2)



$\Rightarrow \tan\alpha(z) = \frac{dz}{dx}$

$\Rightarrow \frac{dz}{dx} = \frac{\sin\alpha(z)}{\cos\alpha(z)}$

$\Rightarrow \frac{dz}{dx} = \frac{\sqrt{1-\cos^2\alpha(z)}}{\cos\alpha(z)} = \frac{\sqrt{1-A/n^2(z)}}{A/n^2(z)}$

$\Rightarrow \frac{dz}{dx} = \sqrt{\frac{n^2(z)}{A^2}-1}$ où $n^2(z) = \frac{z-b}{a}$

Soit : $\frac{dz}{dx} = \sqrt{\underbrace{\left(\frac{z-b}{aA^2}\right)}_{u} - 1}$ où $du = \frac{dz}{aA^2}$

$\frac{du}{\sqrt{u}} = dx$

$\left[\sqrt{u}\right]_{-\frac{b}{aA^2}-1}^{\frac{z-b}{aA^2}-1} = 2x$

$\frac{z+|b|}{aA^2} - 1 = \left(2x + \sqrt{\frac{|b|}{aA^2}-1}\right)^2$

⚠ $n = \frac{z-b}{a} \sim 1$

$\Rightarrow \begin{cases} |b| \gg z \\ |a| \sim |b| \end{cases}$

si $a>0$ alors $b<0$ (et inversement)

(par la suite on prend $b<0$)

$$\frac{z}{aA^2} = 4x^2 + 4x\sqrt{\frac{|b|}{aA^2} - 1}$$

$$\boxed{z = 4ax^2A^2 + 4\sqrt{|b| - aA^2}\,x} \quad \text{parabole}$$

③ $$n^2 - 1 = \alpha \frac{PM}{RT} = \frac{\alpha P_0 M}{R(T_0 - Kz)} = \frac{\alpha P_0 M}{RT_0}\left(1 + \frac{Kz}{T_0}\right)$$

cste (pour α)

$$\Rightarrow z = \underbrace{\frac{T_0}{K}}_{a}\left(n^2 - \underbrace{\left\{1 + \frac{\alpha P_0 M}{RT_0}\right\}}_{\frac{|b|}{a} \sim 1}\right)$$

NB: | on a utilisé le modèle linéaire :
$T = T_0 - kz$ avec $kz \ll T_0$