07/11/11 Pauta Auxiliar #1: 1/2 Jorge Villarroel

P1) Nivelación Geométrica Cerrada: (tramo CD)

Pto	LAt [m]	LAD [m]	$desn^{SC}_{(+)}$	$desn^{SC}_{(-)}$	$desn^{C}_{(+)}$	$desn^{C}_{(-)}$
C	3,54					
PC1	3,56	0,95	2,59		2,589	
PC2	3,481	0,44	3,12		3,119	
PC3	3,87	0,12	3,361		3,36	
PC4	3,94	0,15	3,72		3,719	
D	1,01	1,12	2,82		2,819	
PC5	1,353	3,51		2,5		2,501
PC6	0,658	3,895		2,542		2,543
PC7	0,421	3,875		3,217		3,218
PC8	0,142	3,945		3,524		3,525
C		3,961		3,819		3,820
Suma	21,975	21,966	15,611	15,602	15,606	15,606

$e_c = 0{,}009$

$e_u = 2{,}88 \times 10^{-4}$

obs: • $e_c = \sum LAt - \sum LAD = \sum desn^{s/c}_{(+)} - \sum desn^{s/c}_{(-)}$

• $e_u = \dfrac{e_c}{\sum |desn^{s/c}|}$

$$\Rightarrow \boxed{desn_{CD} = \sum desn^{c}(+) = \sum desn^{c}(-) = 15{,}606\ m}$$

Tramo AB: Distancia con mira horizontal $D_h = \dfrac{1}{\tan \alpha}$

$$D_{h_1} = \frac{1}{\tan(0{,}47)} \Rightarrow D_{h_1} = 135{,}449\,m$$

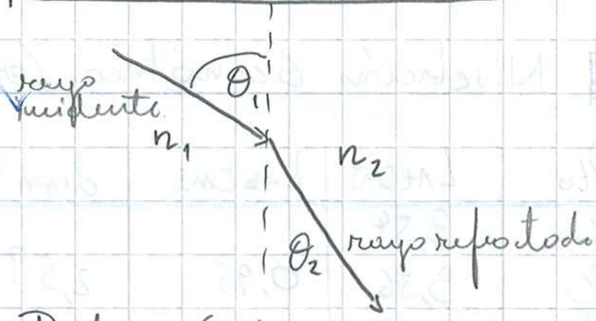
$$D_{h_2} = \frac{1}{\tan(0{,}44)} \Rightarrow D_{h_2} = 144{,}684\,m$$

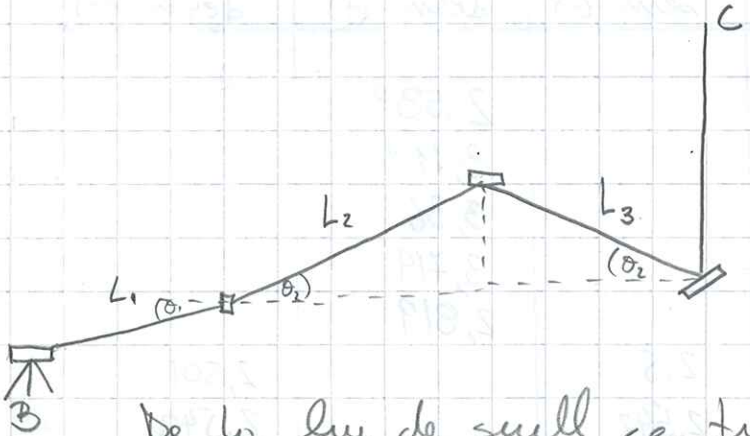
$D_{h_{AB}} = \text{prom}(D_{h_1}, D_{h_2})$

$$\therefore \boxed{D_{h_{AB}} = 140{,}066\,m}$$

Tramo BC: * <u>Ley de snell</u>: $\boxed{n_1 \operatorname{sen} \theta_1 = n_2 \operatorname{sen} \theta_2}$

n_i: índices de refracción





* <u>Distanciómetro</u>:

$$\boxed{D_n = \lambda \left(N + \frac{\phi}{2\pi} \right)}$$

De la ley de snell se tiene: $n_1 \operatorname{sen} \theta_1 = n_2 \operatorname{sen} \theta_2$

$$\Rightarrow \theta_1 = \operatorname{arcsen} \left(\frac{n_2}{n_1} \operatorname{sen} \theta_2 \right) \quad (1)$$

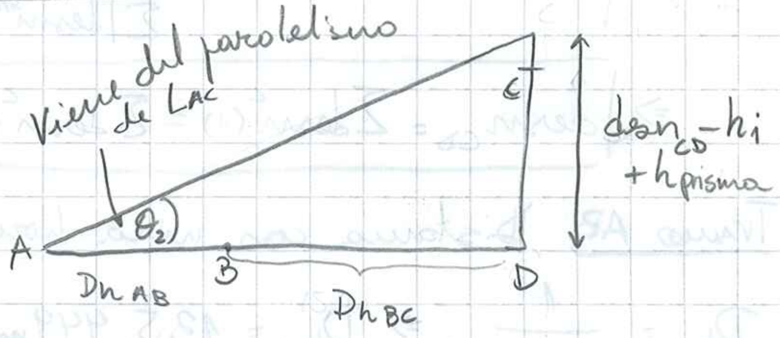
• Con el distanciómetro ($\lambda = 7m$)

$$L_1 = \lambda \left(N_1 + \frac{\phi_1}{2\pi} \right) = 15,166 \, m \, ; \, L_2 = 21,438 \, m \, ; \, L_3 = 16,625 m$$

Se puede ver que: $D_{h_{BC}} = L_1 \cos \theta_1 + L_2 \cos \theta_2 + L_3 \cos \theta_3$

$$\Rightarrow \boxed{D_{h_{BC}} = 15,166 \cos \theta_1 + 38,063 \cos \theta_2} \; (2)$$

Se pretende realizar:



* <u>Enunciado</u>:
<u>Cota A = Cota D.</u>

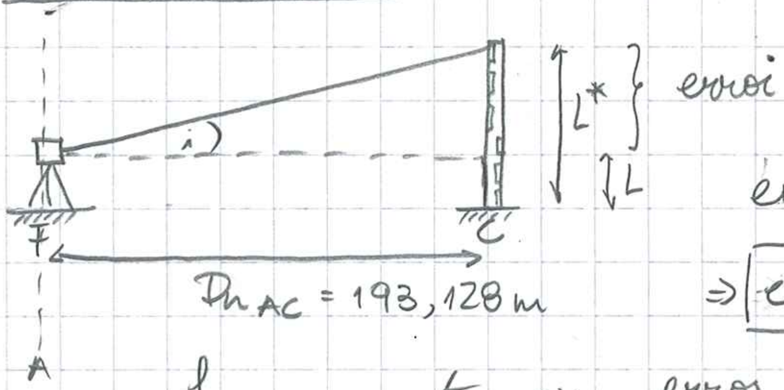
$$\tan \theta_2 = \frac{\operatorname{desn}_{CO} - h_i + h_{prisma}}{D_{h_{AB}} + D_{h_{BC}}} = \frac{15,606 - 1,21 + 1,5}{140,066 + 15,166 \cos \underbrace{\theta_1}_{\operatorname{arcsen}(0,87 \operatorname{sen} \theta_2)} + 38,063 \cos \theta_2}$$

$$\Rightarrow \boxed{\theta_2 = 5,22811^{grad}}$$ Usar n-solve de la TI.

$$\Rightarrow D_{h_{BC}} = 53,062 \, m \quad \Rightarrow \boxed{D_{h_{AC}} = 193,128 m}$$

Ahora se tiene:

• Enunciado: Cota C = Cota F.



$$\text{error} = L^* - L = L^* - h_{i_2}$$

$$\Rightarrow \boxed{\text{error} = 0{,}244\ m}$$

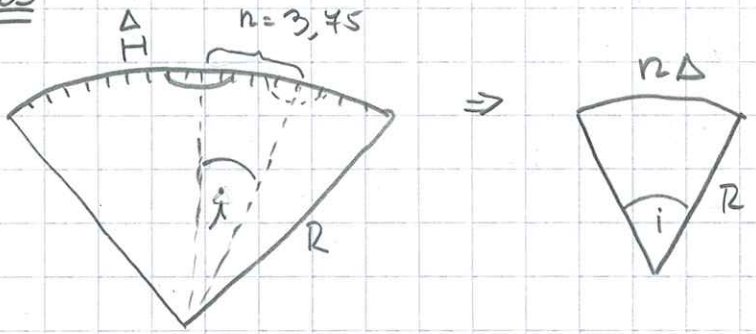
Luego: $\tan(i) = \dfrac{\text{error}}{Dh_{AC}}$

$$\Rightarrow \tan(i) = 0{,}00126$$

Para ángulos pequeños, $\tan(i) \approx i \Rightarrow \boxed{i = 0{,}00126}$

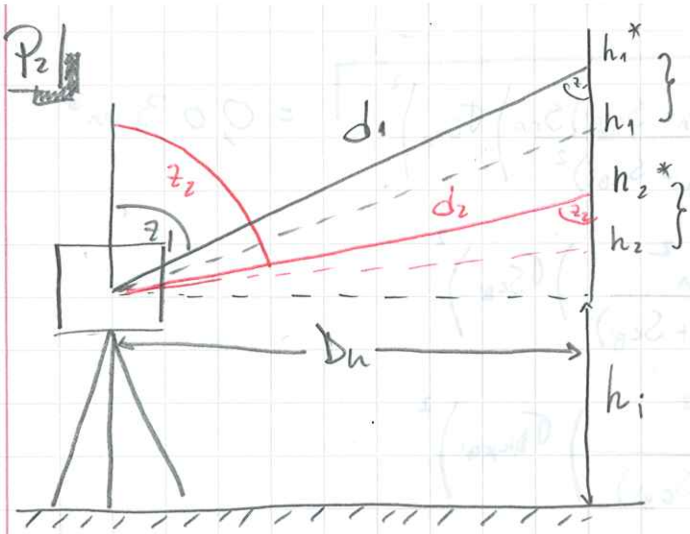
$$^{*}\ i = \frac{n\Delta}{R} \Rightarrow R = \frac{3{,}75 \times (1/10)(0{,}025)}{0{,}00126} = 7{,}44\ m$$

*obs



$$n \cdot \Delta = R i$$

$$\Rightarrow \boxed{i = \frac{n\Delta}{R}}$$



$e_{CT} = 0{,}42 \dfrac{d_1^2}{R_T}$

$e_{CT} = 0{,}42 \dfrac{d_2^2}{R_T}$

Ojo: $h_1^* - h_1 = 0{,}42 \dfrac{d_1^2}{R_T} \wedge h_2^* - h_2 = 0{,}42 \dfrac{d_2^2}{R_T}$ $(*)$

Veaus: $d_1 = \dfrac{D_h}{\operatorname{sen}(z_1)} \wedge d_2 = \dfrac{D_h}{\operatorname{sen}(z_2)}$

Expresión para D_h:

$$\tan(z_1) = \frac{D_h}{h_1^* - h_i} \Rightarrow h_i = h_1^* - \frac{D_h}{\tan(z_1)} \quad (1)$$

$$\tan(z_2) = \frac{D_h}{h_2^* - h_i} \Rightarrow h_i = h_2^* - \frac{D_h}{\tan(z_2)} \quad (2)$$

Igualamos (1) = (2):

$$h_1^* - \frac{D_h}{\tan(z_1)} = h_2^* - \frac{D_h}{\tan(z_2)} \Rightarrow (h_1^* - h_2^*) = D_h \left(\frac{1}{\tan(z_1)} - \frac{1}{\tan(z_2)} \right)$$

$$\Delta^* = (h_1^* - h_2^*) = D_h \cdot \left(\frac{\cos z_1 \operatorname{sen} z_2 - \cos z_2 \operatorname{sen} z_1}{\operatorname{sen} z_1 \operatorname{sen} z_2} \right)$$

$$\Rightarrow (h_1^* - h_2^*) = \frac{D_h \cdot \operatorname{sen}(z_2 - z_1)}{\operatorname{sen}(z_1) \operatorname{sen}(z_2)} \;//$$

$$\therefore \boxed{D_h = (h_1^* - h_2^*)\,\frac{\operatorname{sen} z_1 \cdot \operatorname{sen} z_2}{\operatorname{sen}(z_2 - z_1)}} \quad (3)$$

Reemplazando lo de (*) en (3).

$$\Rightarrow D_h = \left((h_1 - h_2) + \frac{0{,}42}{R_T} D_h^2 \underbrace{\left(\frac{1}{\operatorname{sen}^2(z_1)} - \frac{1}{\operatorname{sen}^2(z_2)} \right)}_{a} \right) \underbrace{\frac{\operatorname{sen} z_1 \cdot \operatorname{sen} z_2}{\operatorname{sen}(z_2 - z_1)}}_{b} \quad (4)$$

$$\Rightarrow \frac{0{,}42}{R_T}(a \cdot b) \cdot \underline{\underline{D_h}}^2 - \underline{\underline{D_h}} + (h_1 - h_2) \cdot b = 0 \quad \leftarrow \text{Ec. Cuadrática}$$

Solución única $\Rightarrow$ determinante $b^2 - 4ac = 0$

$$\Leftrightarrow 1 - 4 \cdot \frac{0{,}42}{R_T} a \cdot b \cdot (h_1 - h_2) b = 0$$

$$\Rightarrow (h_1 - h_2) = \frac{R_T}{4 \cdot 0{,}42\, b^2 \cdot a} \quad (5)$$

Si reemplazamos esta ecuación (5) en la ecuación (4), se tiene:

$$\boxed{D_h = D_h(z_1, z_2, R_T)}\ //$$