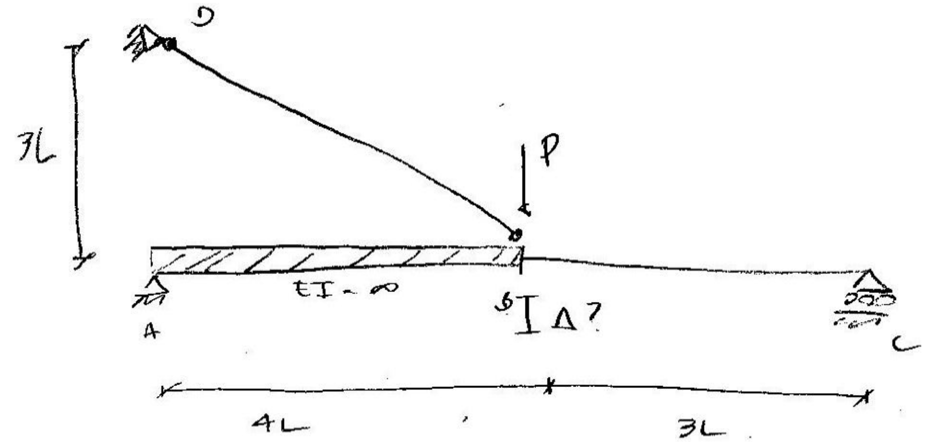
1

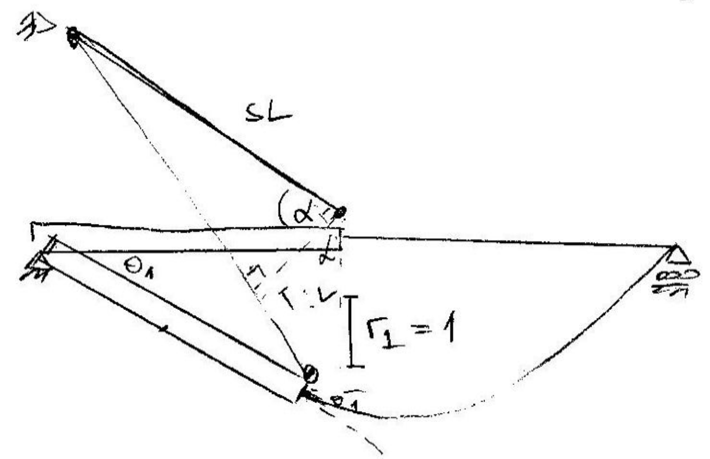
P2 E7 2009 -02



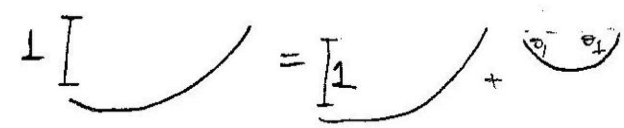
GIC = 1

$\cos\alpha = 4/5$

$\sin\alpha = 3/5$



Para el elemento en flexion

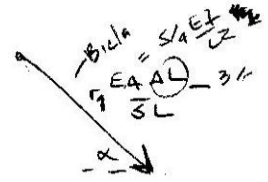


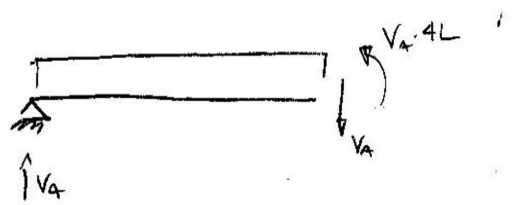
Por comp. de def $\Rightarrow \theta_1 \cdot 4L = 1$

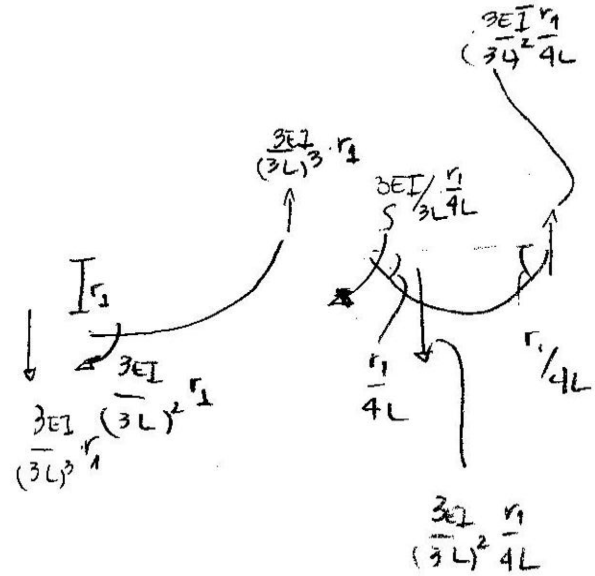
$\Rightarrow \theta_1 = 1/4L$ //

Δlarg biela: $\Delta L = 1 \cdot \sin\alpha = 3/5$ //

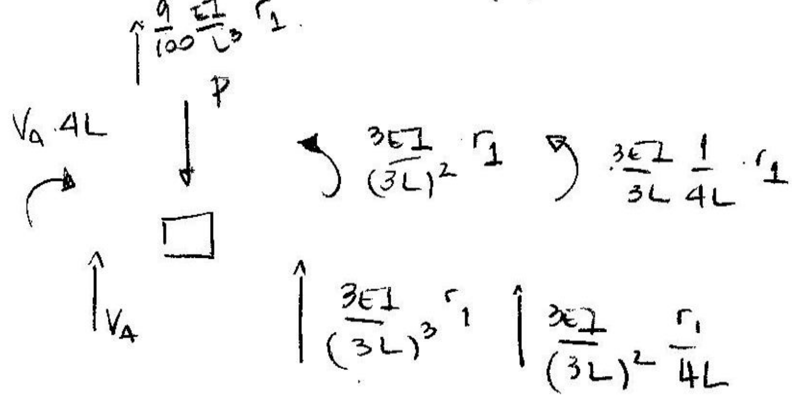
luego, haciendo un DCL en el nudo.







NUDO ⟹



$$\Sigma F_y = 0 \quad \Rightarrow \quad P = V_A + \frac{3EI}{(3L)^3} r_1 + \frac{3EI}{(3L)^2}\frac{r_1}{4L} + \frac{9}{100}\frac{EI}{L^3} r_1 \qquad (1)$$

$$\Sigma M_0 = 0 \quad \Rightarrow \quad V_A \cdot 4L = \frac{3EI}{9L^2} r_1 + \frac{3EI}{12L^2} \cdot r_1 \qquad (2)$$

$$(1) \text{ y } (2) \Rightarrow \quad \boxed{r_1 = 2{,}324 \frac{PL^3}{EI}} \qquad \boxed{V_A = 0{,}3389 P}$$

3

Analogamente , haciendolo por el método tradicional

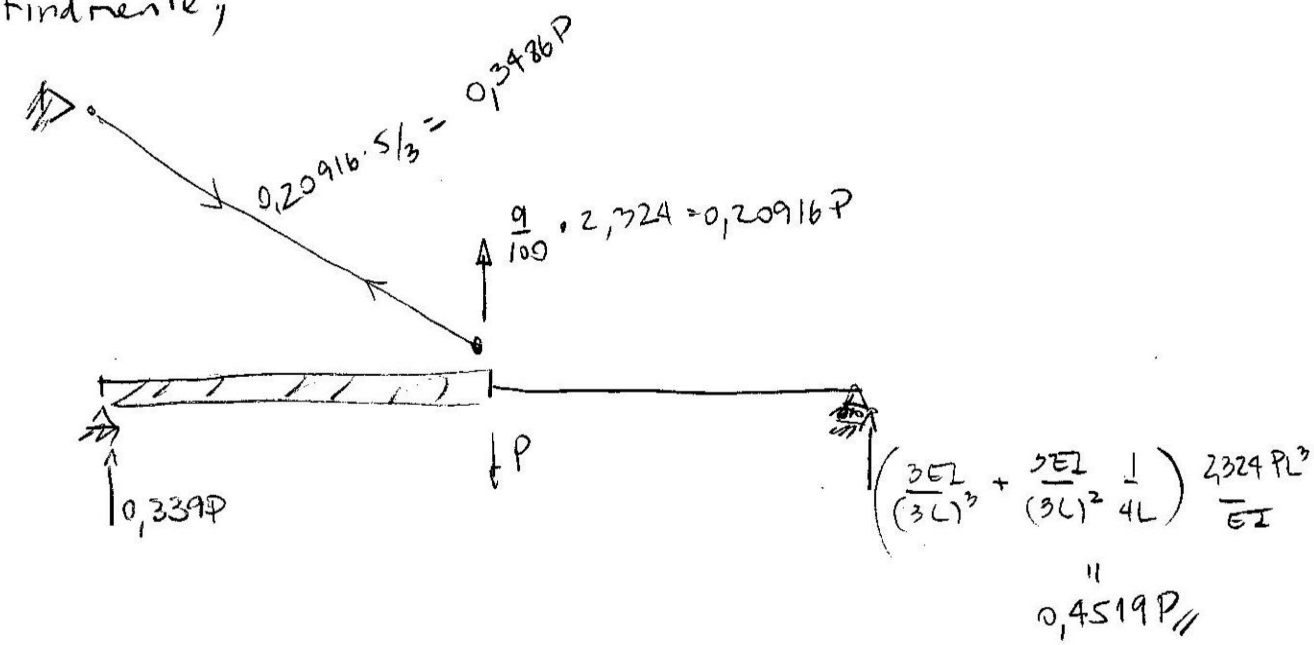
$$K_{11} = \frac{3EI}{(3L)^3} + \frac{3EI}{(3L)^2} \cdot \frac{1}{4L} + \frac{9}{100}\frac{EI}{L^3}$$

con el vector de cargas $R = P - V_A$

$$\Rightarrow \quad K_{11} \cdot r_1 = (P - V_A)$$

y luego , para obtener V_A se hace equilibrio de momento!

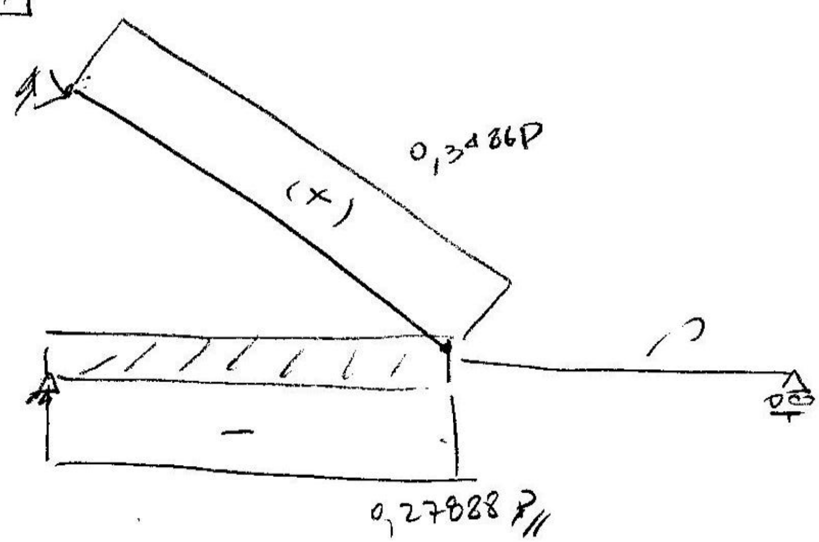
Findmente,



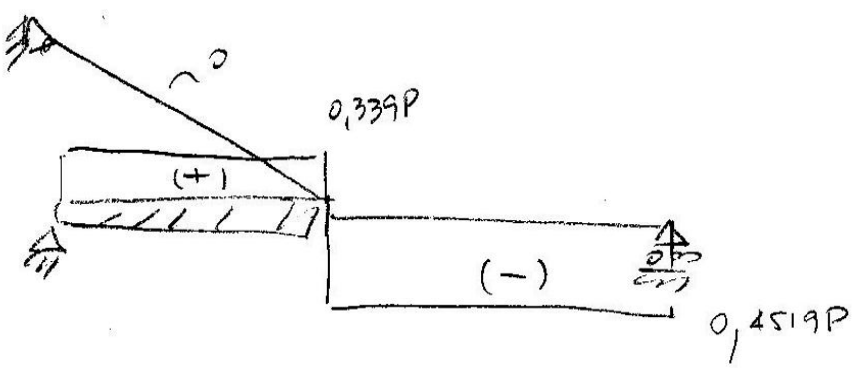
Que cumple el equilibrio de fuerzas y momento

DIAGRAMAS

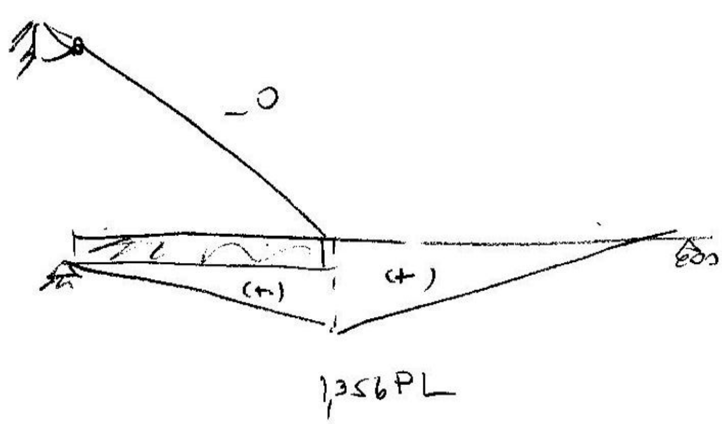
N(x)



Q(x)



M(x)



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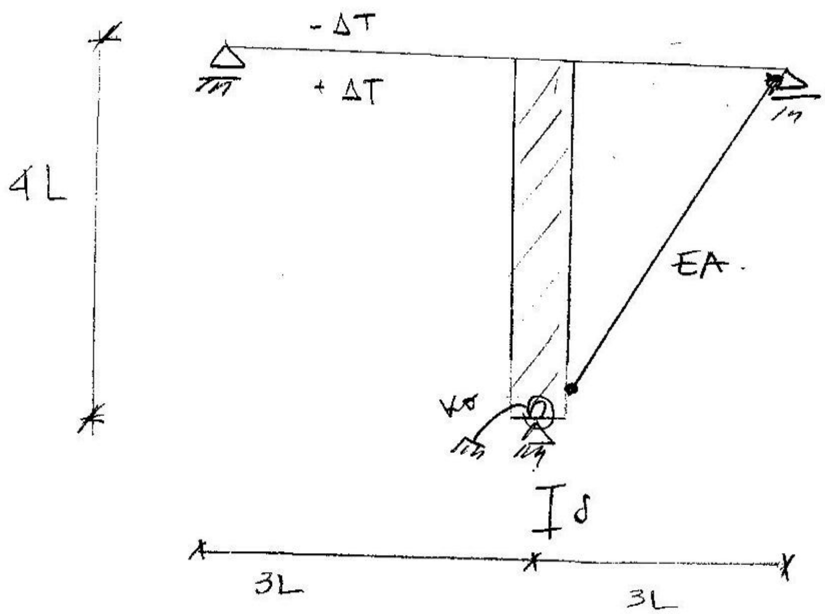
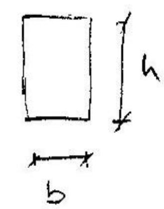
P2.1 Determine GIE, GIC y diagramas de esfuerzos





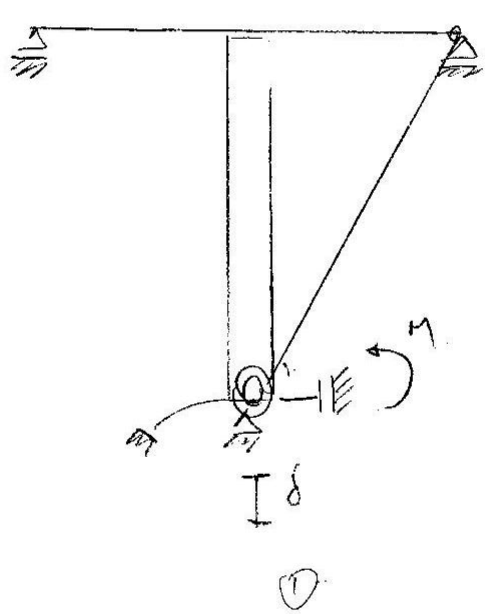
$$\phi = \frac{\alpha \Delta T}{h/2} = \frac{2\alpha \Delta T}{h}$$

$EA = EI/L^2$

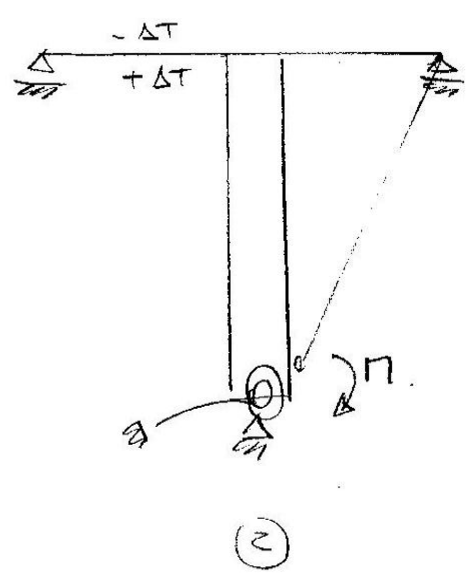
$k_\theta = EI/L$

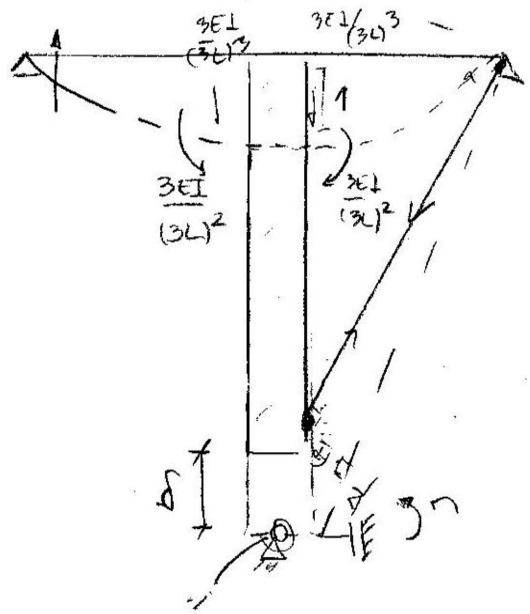
GIE = 3

GIC = 1 ✓ ⇒ Rigidez



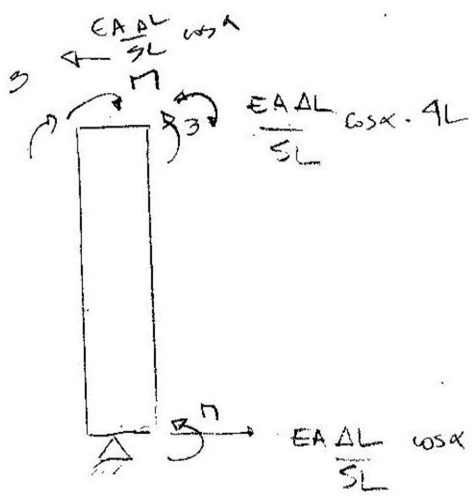
+





$$\Delta L = \delta \cdot \operatorname{sen} \alpha \quad \Rightarrow \quad \Delta L = 4/5\, \delta$$

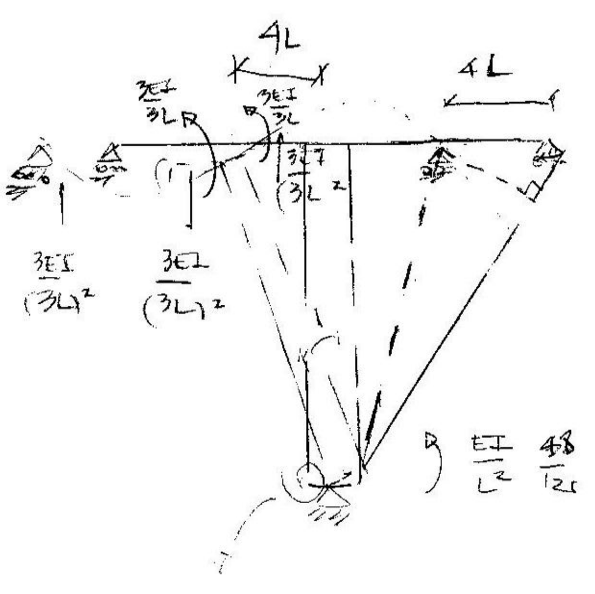
$$\text{Fuerza Biela} = EA \frac{4/5\, \delta}{5L} = \frac{4EA\delta}{25L}$$



$$M = \frac{EA\Delta L}{5L} \cdot \cos\alpha \cdot 4L$$

$$M = \frac{EA\; 4/5\,\delta}{5L} \cdot 3/5 \cdot 4L$$

$$M = \frac{48}{125} \frac{EI}{L^2}\, \delta$$



$$\Delta L = 4L\cos\alpha$$

Brazo palanca

$$K_{11} = \frac{3EI}{3L} \times 2 + \underset{EI/L}{K_\theta}\; \underset{EI/L^2}{1} + \frac{EA}{5L}\, 4L\, 3/5 \cdot 3/5 \cdot 4L$$

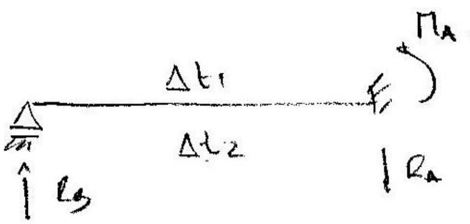
$$\Rightarrow K_{11} = \frac{4{,}15\, EI}{L}$$

(7)

$$\Rightarrow \quad k_{11}\, r_1 = R \qquad\qquad R = M$$

$$r_1 = \frac{\frac{48}{125}\frac{EI}{L^2}\delta}{\frac{4{,}15\,EI}{L}} \qquad\qquad r_1 = 0{,}092\,\frac{\delta}{L}$$

Para la temperatura, sólo cambia el vector de cargas



$$M_A = \frac{3EI\,\alpha\,(\Delta t_1 - \Delta t_2)}{2h}$$

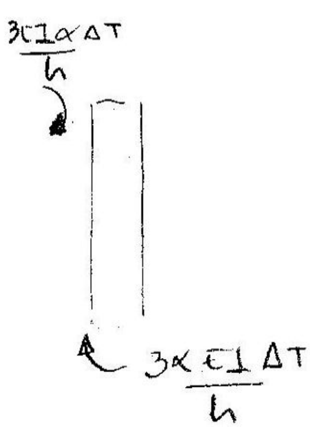
$$R_B = R_A = \frac{3EI\,\alpha\,(\Delta t_1 - \Delta t_2)}{2h\cdot L}$$

para $\Delta t_1 = -\Delta T$, $\Delta t_2 = \Delta t$

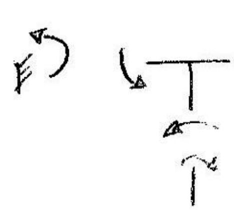
$$\Rightarrow \quad M_A = \frac{3EI\,\alpha\,(-\Delta T - \Delta T)}{2h}$$

$$M_A = \frac{-3\alpha EI\,\Delta T}{h}$$

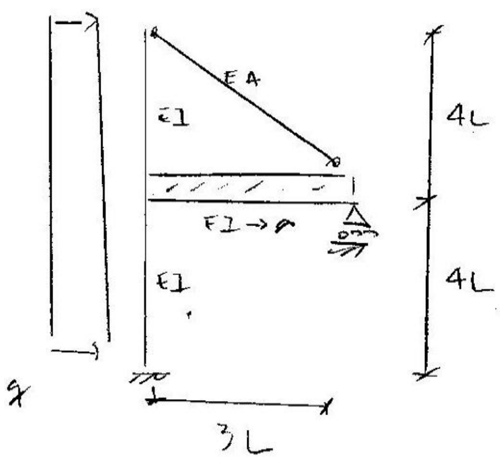
En el nudo,



$$R = \frac{48}{125}\frac{EI}{L^2}\delta + \frac{3\alpha EI\,\Delta T}{h}$$



P3 Para la estructura de la fig, determine GIC, reacciones y diagramas de esfuerzos



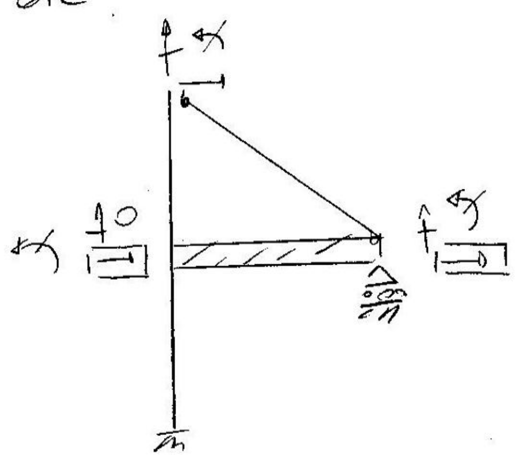
Considere

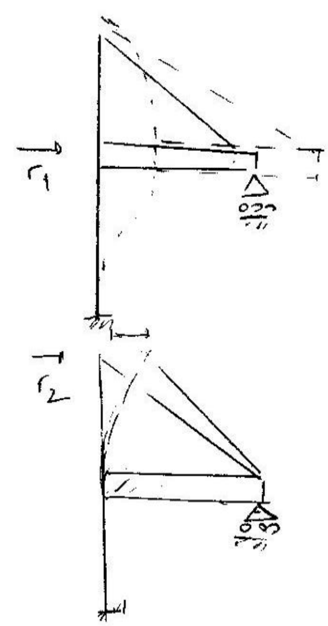
$$EA = EI/L^2$$

(columna y viga axialmente rigidas)

Soluc

GIC





Matriz de rigidez

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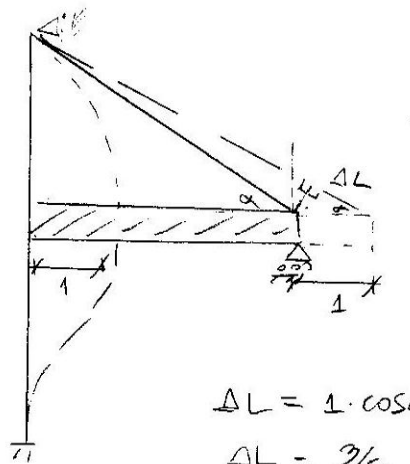
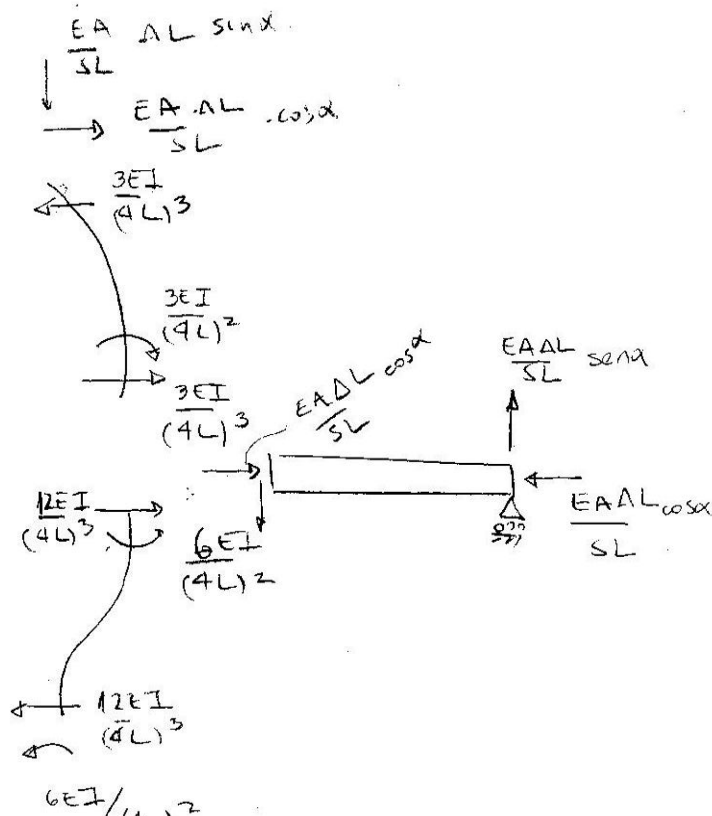
$r_1 = 1 \quad , r_2 = 0$

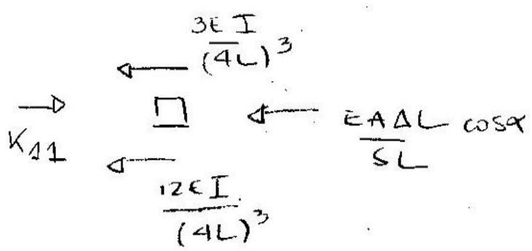




$\Delta L = 1 \cdot \cos\alpha$

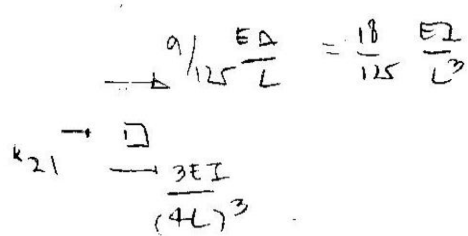
$\Delta L = 3/5$

En el nodo,



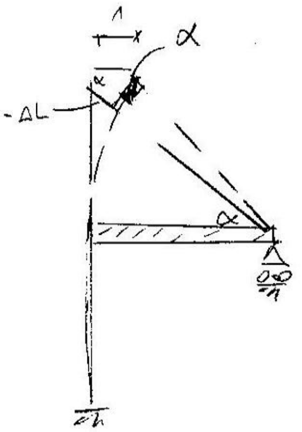
$$K_{11} = \frac{15EI}{64L^3} + \frac{2EI \cdot 3/5 \cdot 3/5}{5L^3}$$

$$K_{11} = 0{,}378 \frac{EI}{L^3}$$

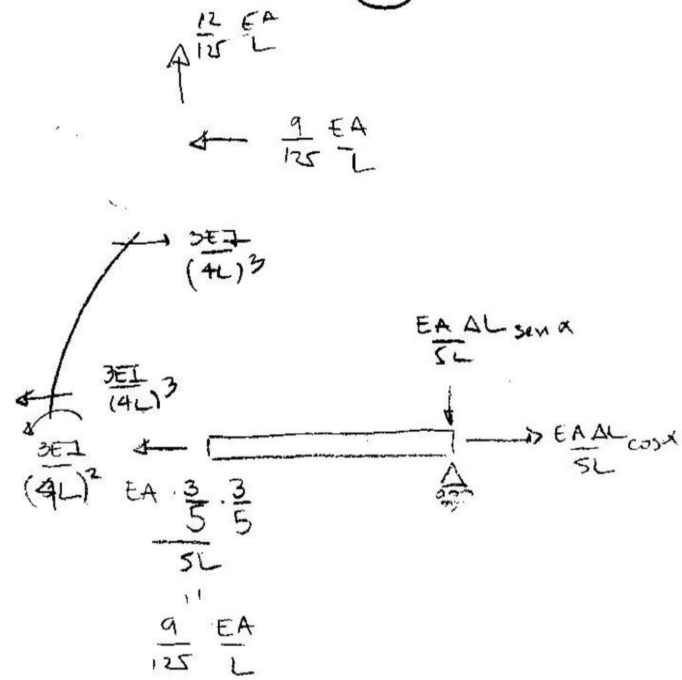


$$k_{21} = -0{,}191 \frac{EI}{L^3}$$

$\underline{r_2 = 1, \quad r_1 = 0}$



$\Delta L = 1 \cos\alpha$
$= 3/5$



$\frac{12}{125}\frac{EI}{L^3}$

$\underset{K_{22}}{\longrightarrow} \;\square\; \longleftarrow \frac{3EI}{(4L)^3} \quad \Rightarrow \quad K_{22} = 0{,}191 \frac{EI}{L^3}$

$\longrightarrow \frac{3EI}{(4L)^3}$

$\underset{K_{12}}{\longrightarrow} \;\square\; \longrightarrow \frac{9}{125}\cdot\frac{2EI}{L^3} \quad \Rightarrow \quad K_{12} = 0{,}191 \frac{EI}{L^3}$

Propuesto $\Longrightarrow$ El resto!