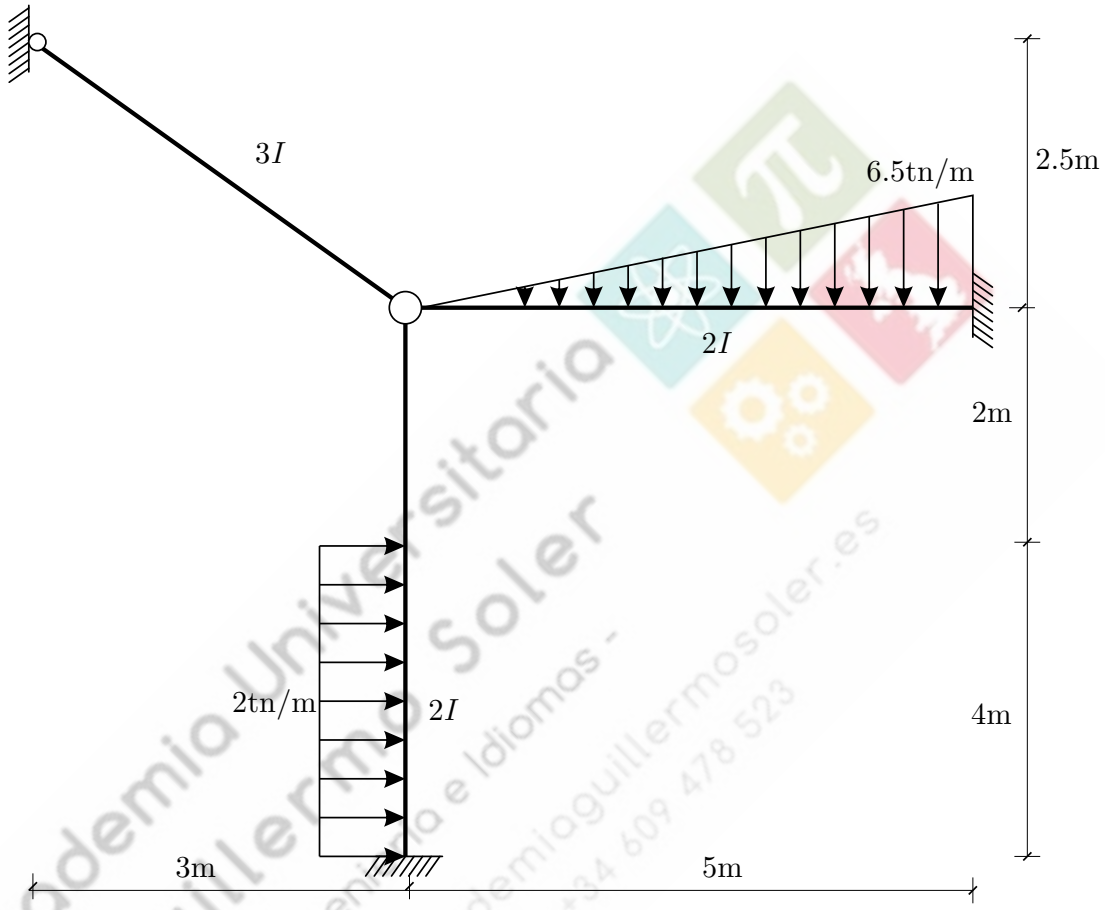
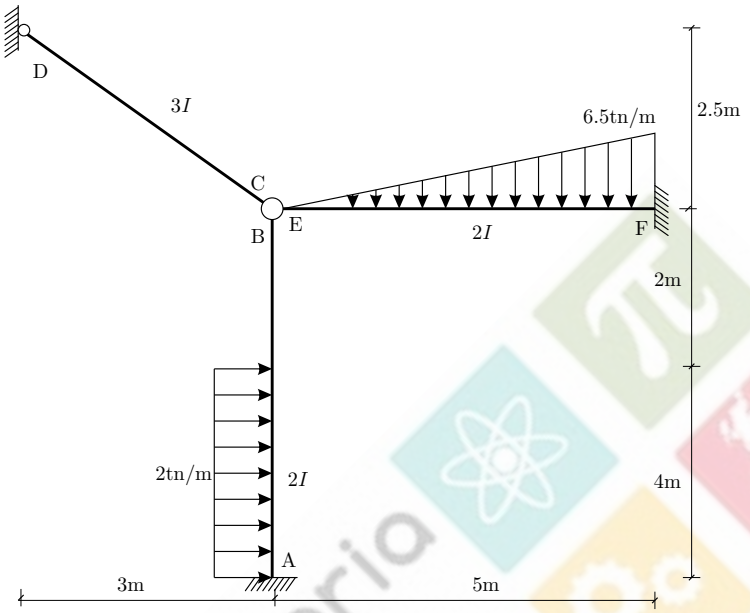
Calcular la siguiente estructura por el Método de la Rigidez






Planteando las escuaciones se tiene

$$M_{63} = 0.136\,(-4) = -0.54$$
$$M_{AB} = \frac{2E\,(2I)}{6}\,(\theta_B) - 5.333 = 0.667EI\theta_B - 5.333$$
$$M_{BA} = 2E\,(2I)\,(2\theta_B) + 3.556 = 1.333EI\theta_B + 3.556$$
$$M_{EF} = 3E\,(2I)\,2\theta_E - 5.417 = 1.6EI\theta_E - 5.417$$
$$M_{FE} = \frac{2E\,(2I)}{5}\,(\theta_E) + 8.125 = 0.8EI\theta_E + 8.125$$
$$M_{CD} = \frac{2E\,(3I)}{3.91}\,(\theta_C + \theta_D) = 3.073EI\theta_C + 1.536EI\theta_D$$
$$M_{DC} = \frac{2E\,(3I)}{3.91}\,(\theta_C + 2\theta_D) = 1.536EI\theta_C + 3.073EI\theta_D$$

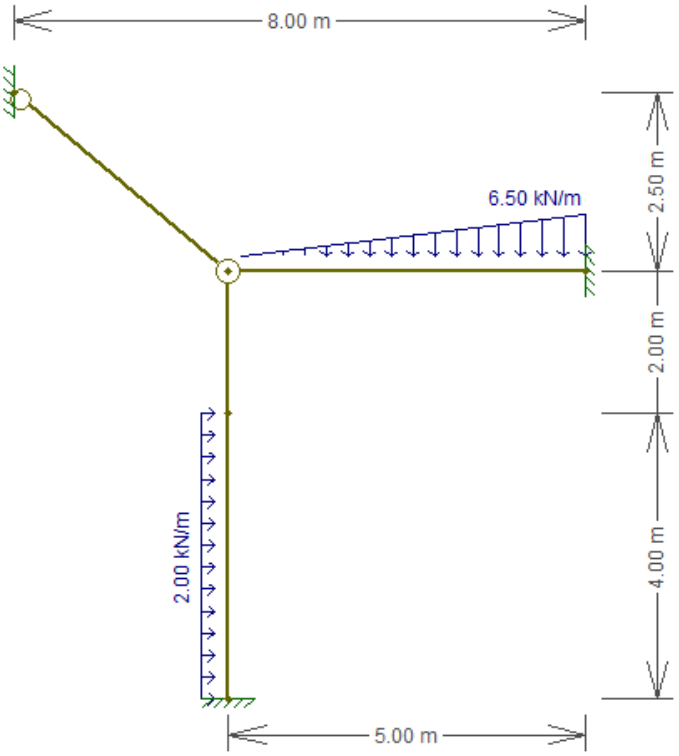
Ecuaciones de equilibrio

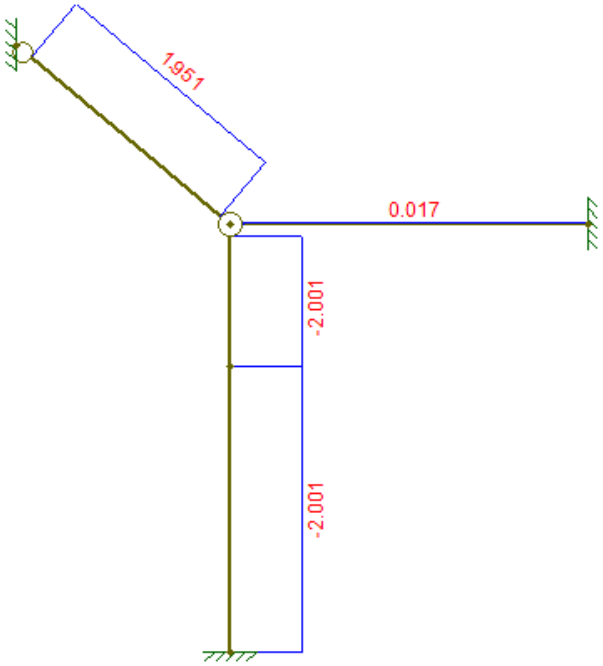
$$M_{BA} = 0$$
$$M_{CD} = 0$$
$$M_{DC} = 0$$
$$M_{EF} = 0$$

$$1.333EI\theta_B + 3.556 = 0 \Rightarrow EI\theta_B = -2.667$$
$$3.073EI\theta_C + 1.536EI\theta_D = 0 \Rightarrow EI\theta_B = -2.667$$
$$1.536EI\theta_C + 3.073EI\theta_D = 0$$

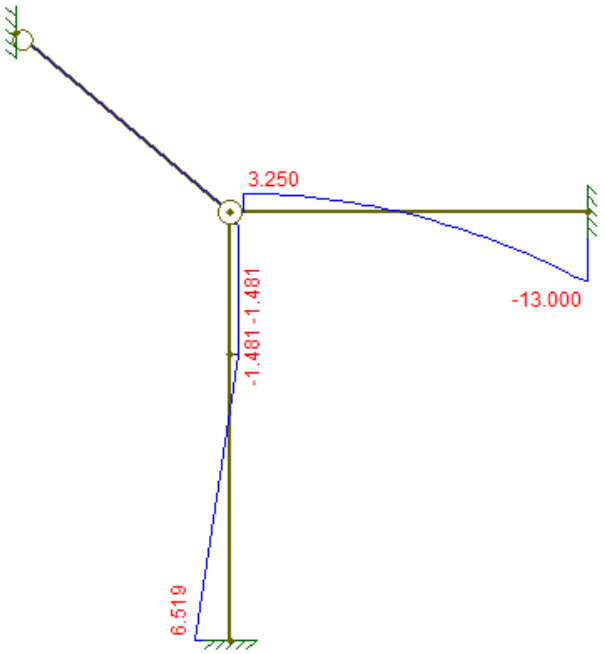
remplazando

$$1.6EI\theta_E - 5.417 = 0 \Rightarrow EI\theta_E = 3.385$$
$$M_{AB} = -7.111$$
$$M_{FE} = 10.833$$
$$M_{CD} = M_{DC} = M_{BA} = M_{EF} = 0$$

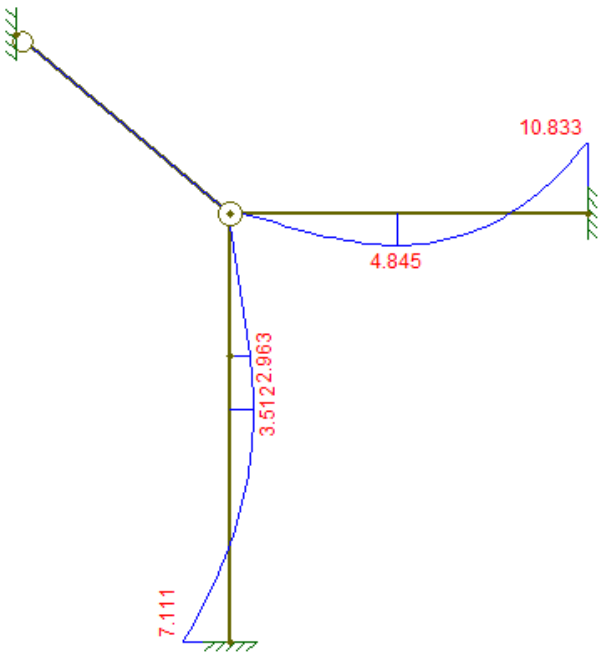



Fuerzas axiales



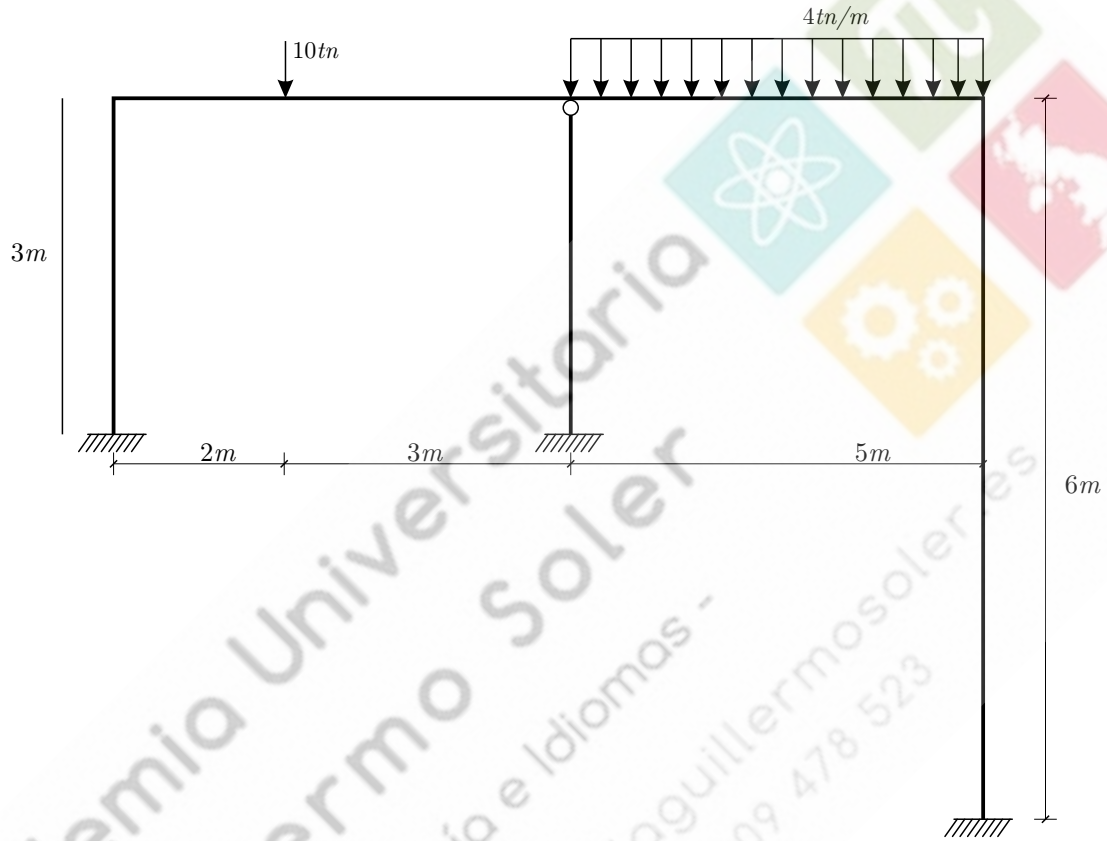

Fuerzas cortantes




Momentos flectores

# Método de Cross

Dibujar el diagrama de momentos flectores la inercia de las barras horizontales es $I1$ y de las verticales $I_2$ sabiendo que la relacion entre ellas es $I_1 = 2I_2$



Calculo de las rigideces relativas

$$K_{12} = \frac{1}{3}\left(\frac{4}{3}\right) = 0.25 \; ; \qquad K_{23} = \frac{2}{5} = 0.4 \quad ; \quad K_{36} = \frac{1}{3}\left(\frac{3}{4}\right) = 0.25$$

$$K_{45} = \frac{1}{6} = 0.167$$

Coeficientes de distribucion

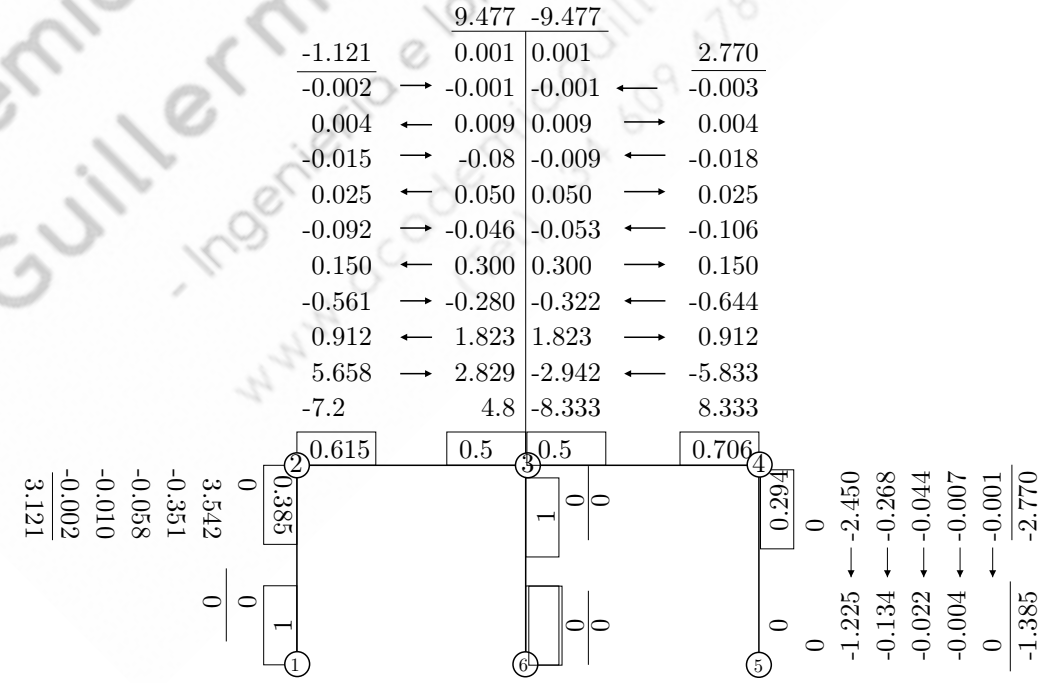
$$C_{12} = 1 \quad ; \quad C_{21} = \frac{0.25}{0.25 + 0.4} = 0.385 \quad ; \quad C_{23} = \frac{0.4}{0.25 + 0.4} = 0.615$$

$$C_{32} = \frac{0.4}{0.4 + 0.4} = C_{34} = 0.5 \quad ; \quad C_{43} = \frac{0.4}{0.4 + 0.167} = 0.706$$

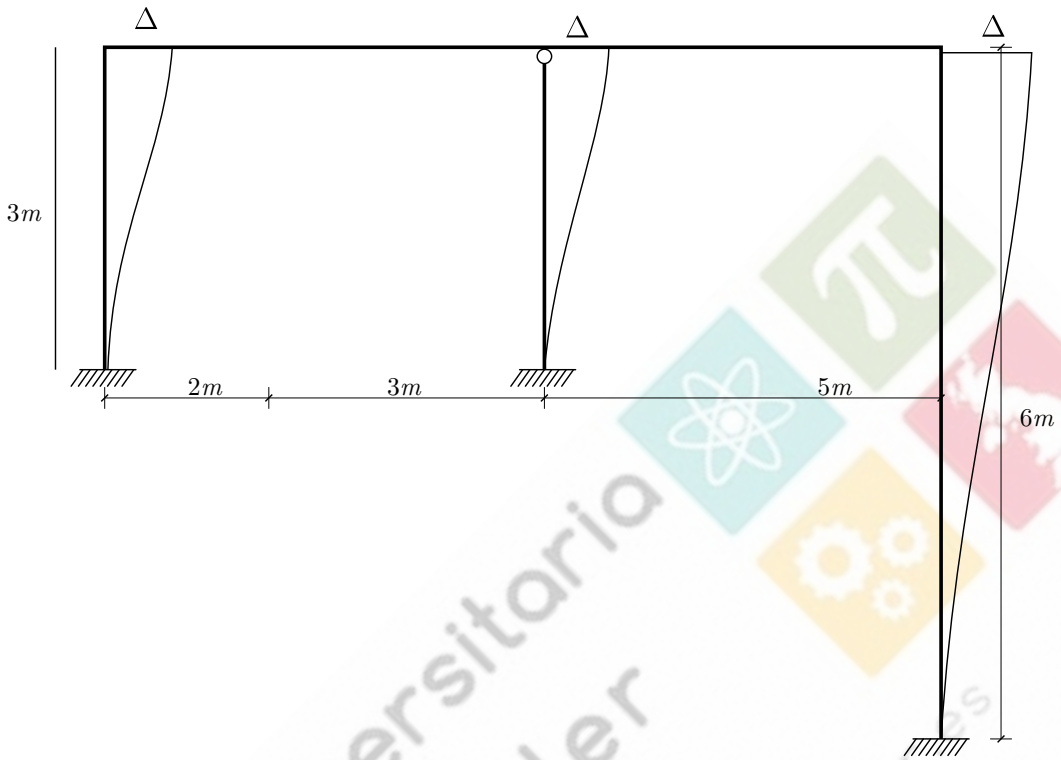
$$C_{45} = \frac{0.167}{0.4 + 0.67} = 0.294 \quad ; \quad C_{63} = 0 \quad C_{54} = 0$$

Momentos de empotramiento

$$M_{20}^0 = 7.2 \quad M_{32}^0 = 4.8$$
$$M_{34}^0 = -8.333 \quad M_{43}^0 = 8.333$$
$$M_{12}^0 = M_{21}^0 = 0$$
$$M_{36}^0 = M_{63}^0 = 0$$
$$M_{45}^0 = M_{54}^0 = 0$$

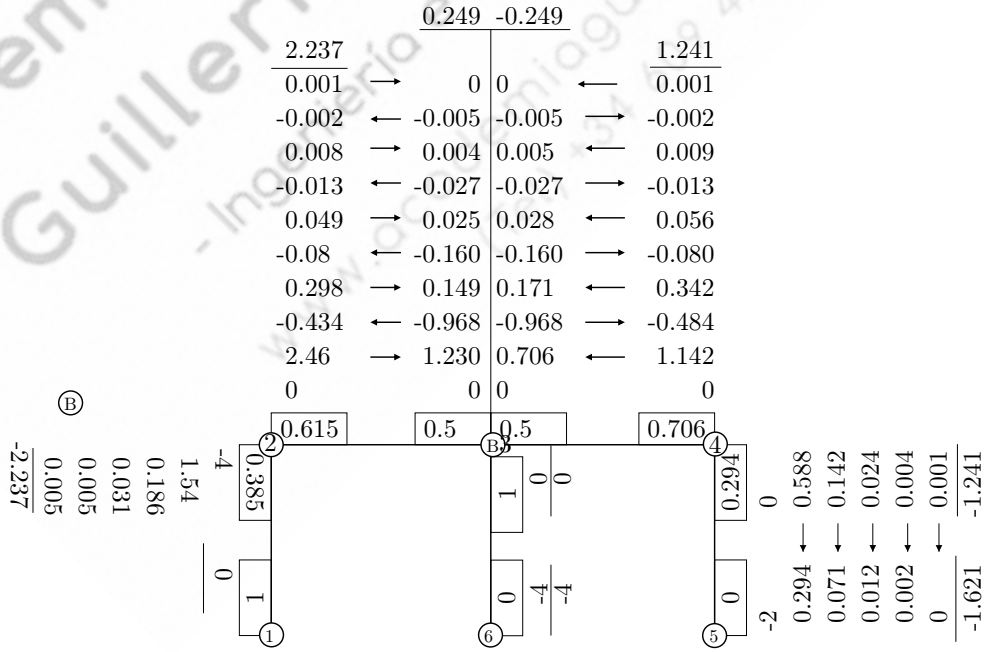


Debido al desplazamiento




$$M_{12} = -\frac{3EI\Delta}{9} = -4 \qquad M_{63} = -\frac{3EI\Delta}{9} = -4$$

$$M^0_{45} = M^0_{54} = -\frac{6EI\Delta}{36} = -2$$



Cortantes de cross sin desplazamiento

$$Q_{12} = -\frac{1}{3}(3.121) = -1.040$$
$$Q_{63} = 0$$
$$Q_{54} = -\frac{1}{6}(-1.385 - 2.770) = 0.693$$

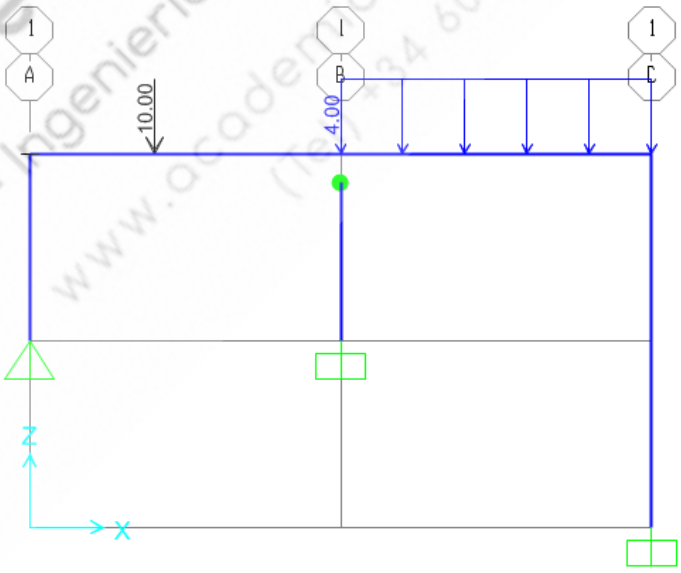
Cortantes de cross con desplazamiento

$$Q_{12} = -\frac{1}{3}(-2.237) = 0.746$$
$$Q_{63} = -\frac{1}{3}(-4) = 1.333$$
$$Q_{54} = -\frac{1}{6}(-1.621 - 1.241) = 0.477$$
$$\Rightarrow -1.040 + 0.693 + x\,(0.746 + 1.333 + 0.477) = 0$$
$$x = 0.136$$

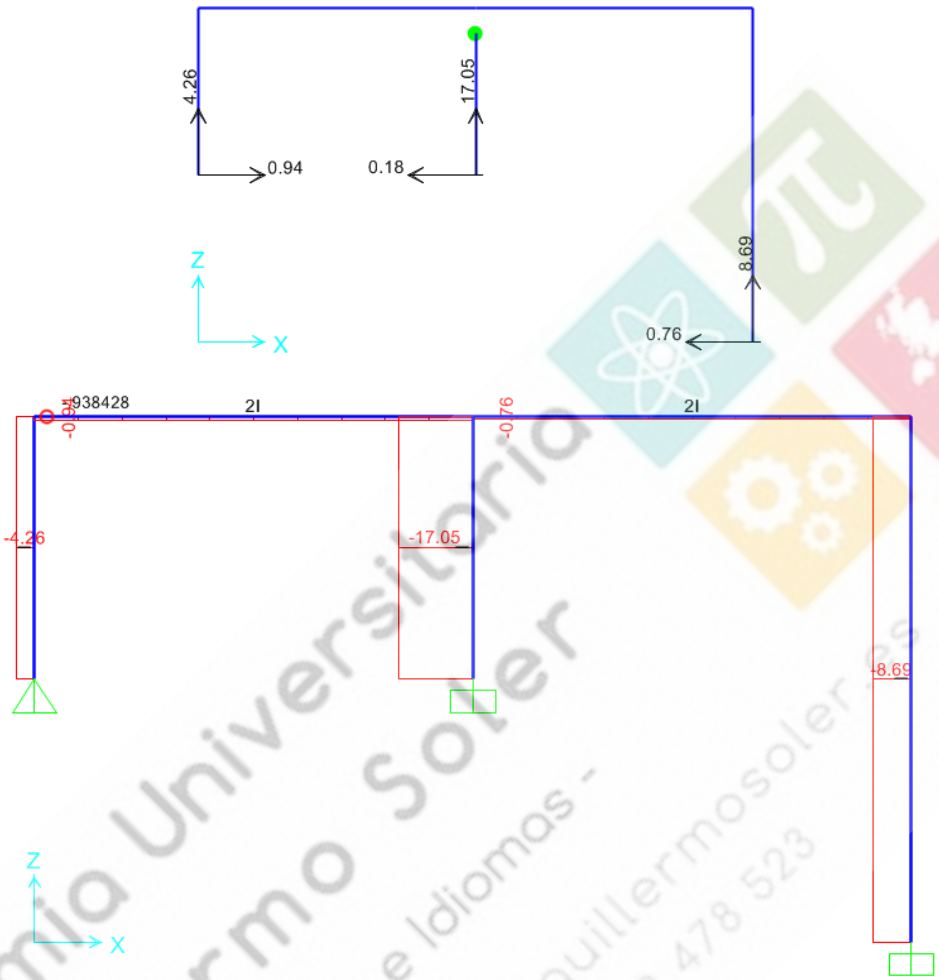
momentos finales

$$M_{12} = 0$$
$$M_{21} = 3.121 + 0.136\,(-2.237) = 2.82$$
$$M_{23} = -1.121 + 0.136\,(2.237) = -2.82$$
$$M_{32} = 9.477 + 0.136\,(0.249) = +9.51$$
$$M_{34} = -9.477 + 0.136\,(-0.249) = -9.51$$
$$M_{43} = 2.770 + 0.136\,(1.241) = 2.94$$
$$M_{45} = -2.770 + 0.136\,(-1.241) = -2.94$$
$$M_{54} = -1.385 + 0.136\,(-1.621) = -1.61$$

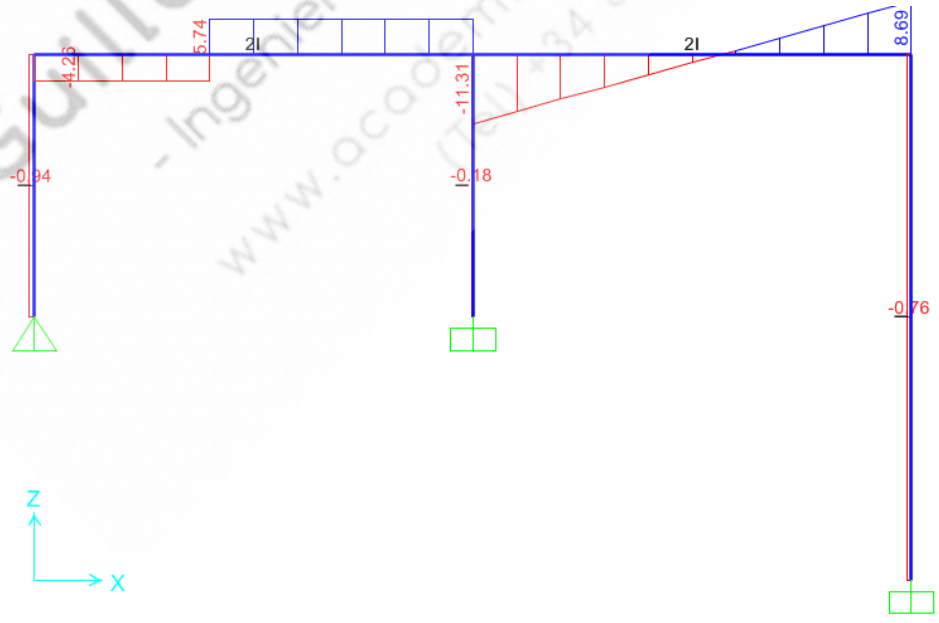
Diagramas

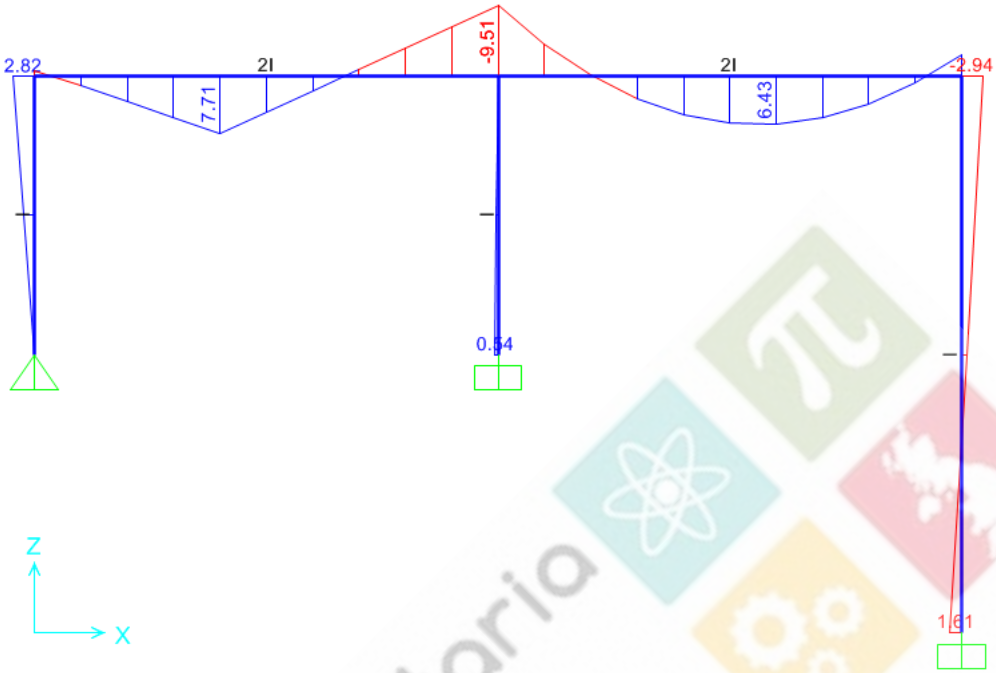



Fuerzas Cortantes




Fuerzas axiales






Momentos flectores