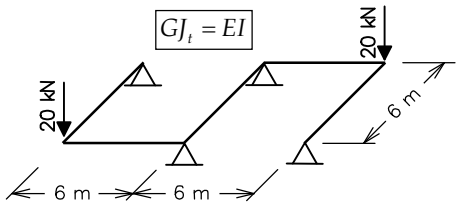
ENG 1204 – ANÁLISE DE ESTRUTURAS II – 2º Semestre – 2016

Segunda Prova – Parte 2 – 28/11/2016 – Duração: 1:45 hs – Sem Consulta

2ª Questão (3,5 pontos)
Empregando-se o Método das Forças, obter os diagramas de momentos fletores e momentos torçores para a grelha ao lado. Todas as barras têm a relação indicada entre a rigidez à torção GJ_t e a rigidez à flexão EI.

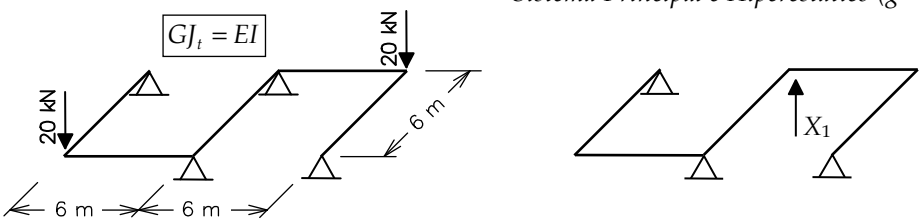


Solução de um sistema de 2 equações a 2 incógnitas:

$$\begin{Bmatrix} e \\ f \end{Bmatrix} + \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix} \Rightarrow \begin{cases} X_1 = \dfrac{bf - de}{ad - bc} \\ \\ X_2 = \dfrac{ce - af}{ad - bc} \end{cases}$$

2ª Questão

Sistema Principal e Hiperestático (g = 1)



Caso (0) – Solicitação externa isolada no Sistema Principal

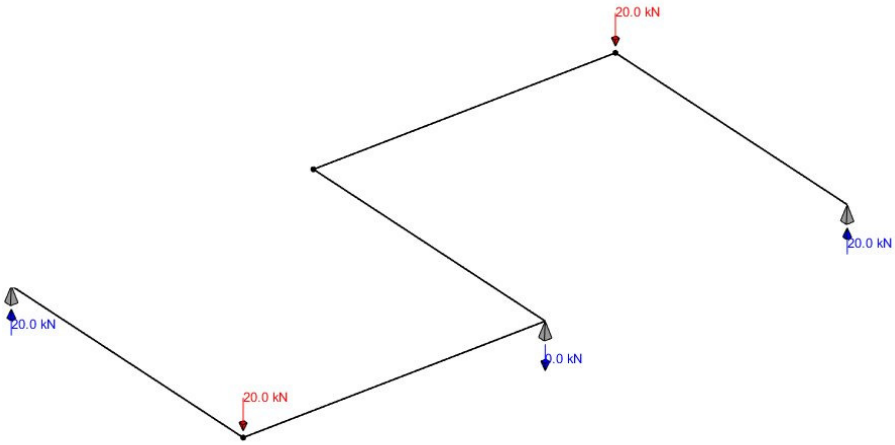


Diagrama de momentos fletores M_0

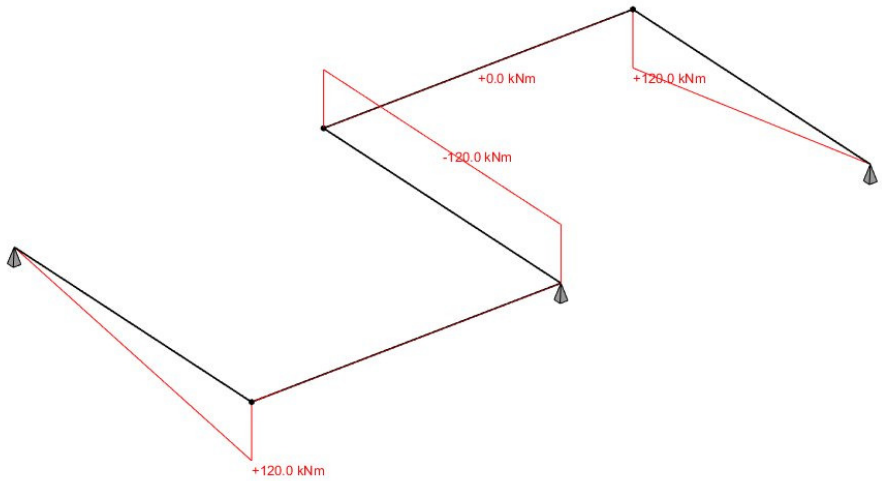
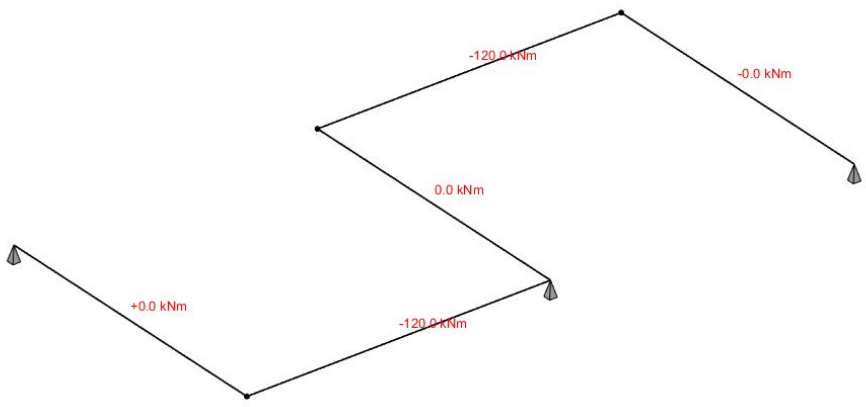


Diagrama de momentos torçores T_0



Caso (1) – Hiperestático X_1 isolado no Sistema Principal

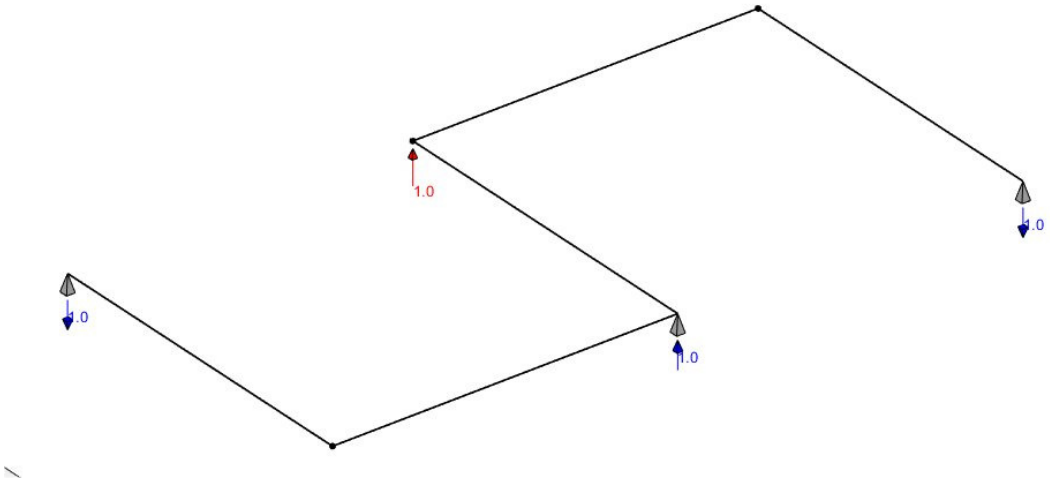


Diagrama de momentos fletores M_1

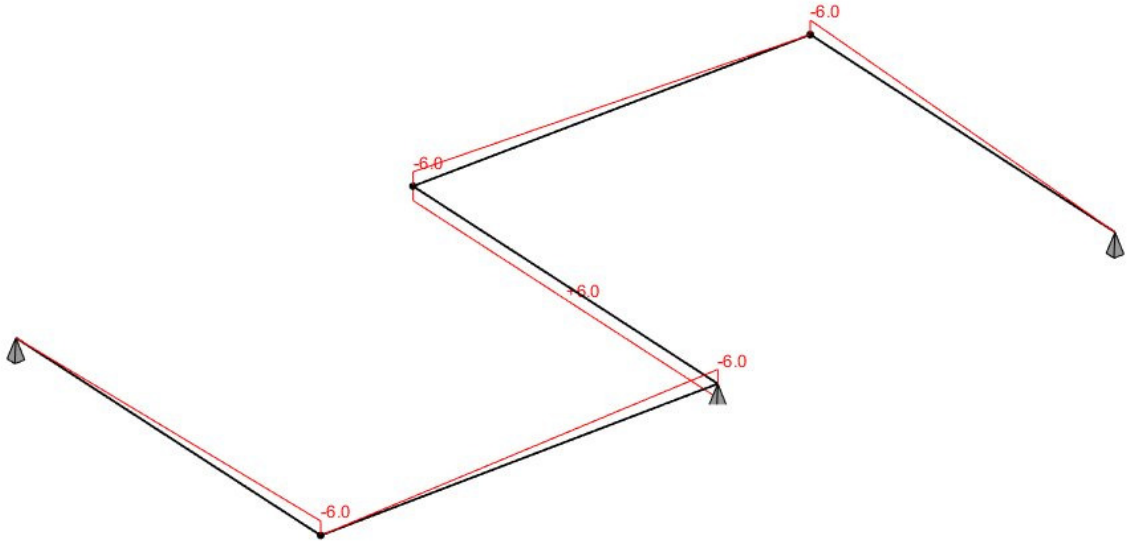
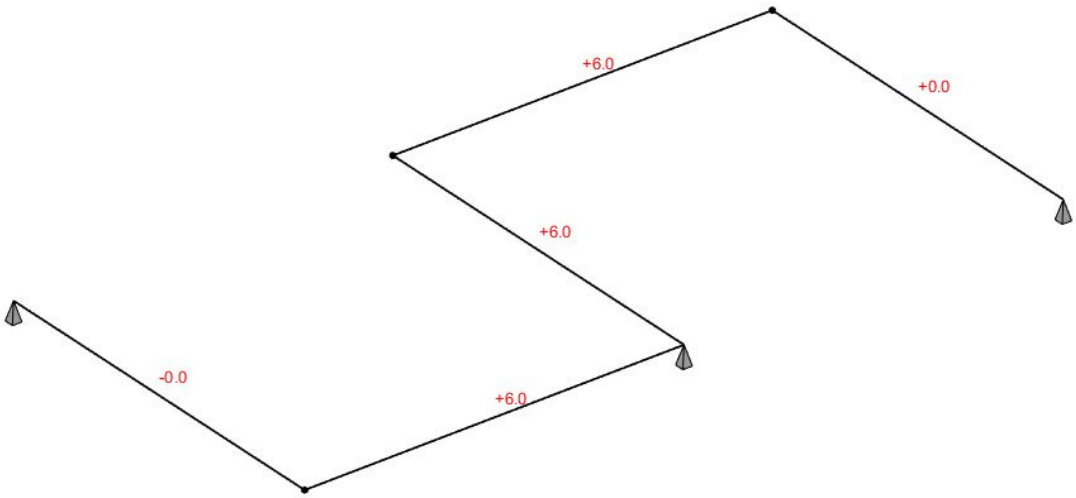


Diagrama de momentos torçores T_1

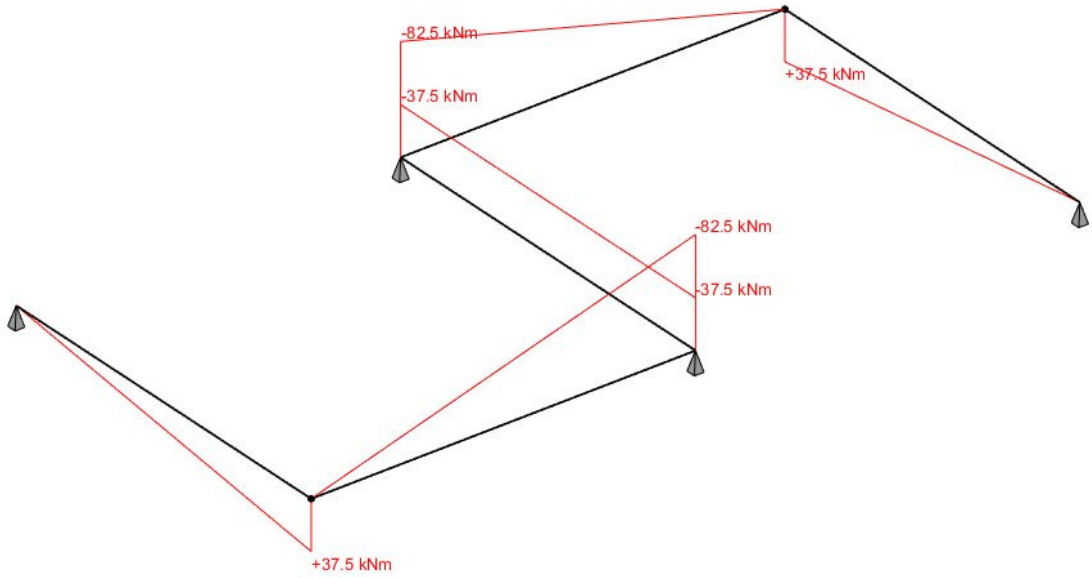


Equação de compatibilidade

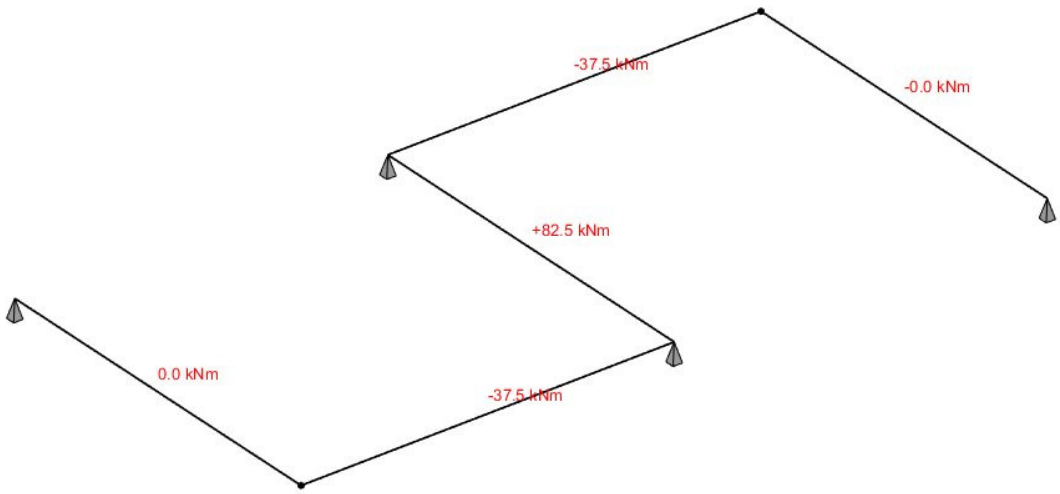
$$\delta_{10}+\delta_{11}X_1=0 \qquad \delta_{10}=\left[-\frac{1}{3}\cdot 6\cdot 120\cdot 6-6\cdot 120\cdot 6-\frac{1}{3}\cdot 6\cdot 120\cdot 6\right]\cdot\frac{1}{EI}+\left[-6\cdot 120\cdot 6-6\cdot 120\cdot 6\right]\cdot\frac{1}{GJ_t}=-\frac{15840}{EI}$$

$$\delta_{11}=\left[4\cdot\left(+\frac{1}{3}\cdot 6\cdot 6\cdot 6\right)\right]\cdot\frac{1}{EI}+\left[3\cdot(-6)\cdot(-6)\cdot 6\right]\cdot\frac{1}{GJ_t}=+\frac{1152}{EI} \quad \Rightarrow -\frac{15840}{EI}+\frac{1152}{EI}\cdot X_1=0 \qquad \therefore X_1=+13.75\,\text{kN}$$

Momentos fletores finais: $M=M_0+M_1\cdot X_1$ (kNm)



Momentos torçores finais: $T=T_0+T_1\cdot X_1$ (kNm)



2ª Questão – Outra opção (2) de Sistema Principal:

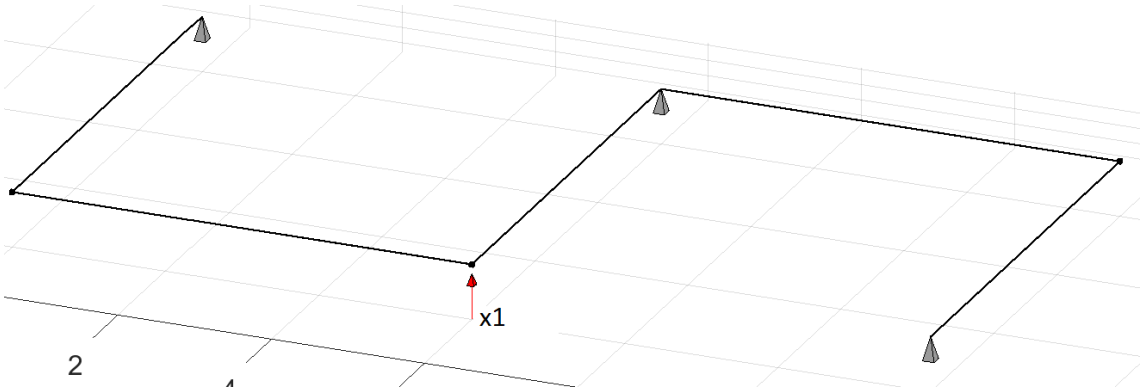


Diagrama de Momentos Fletores M_0

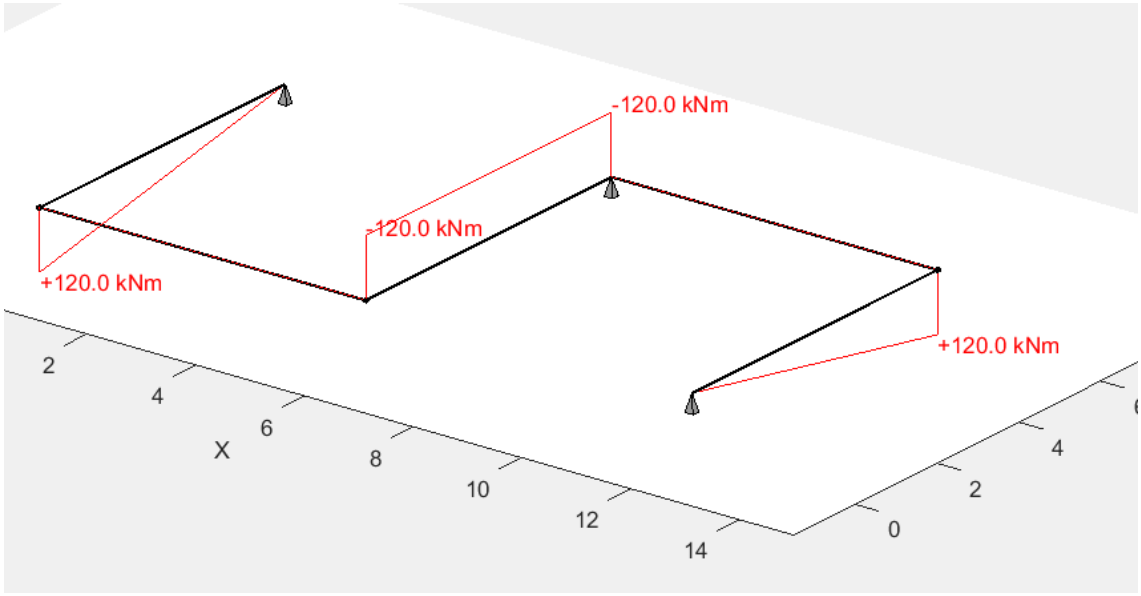
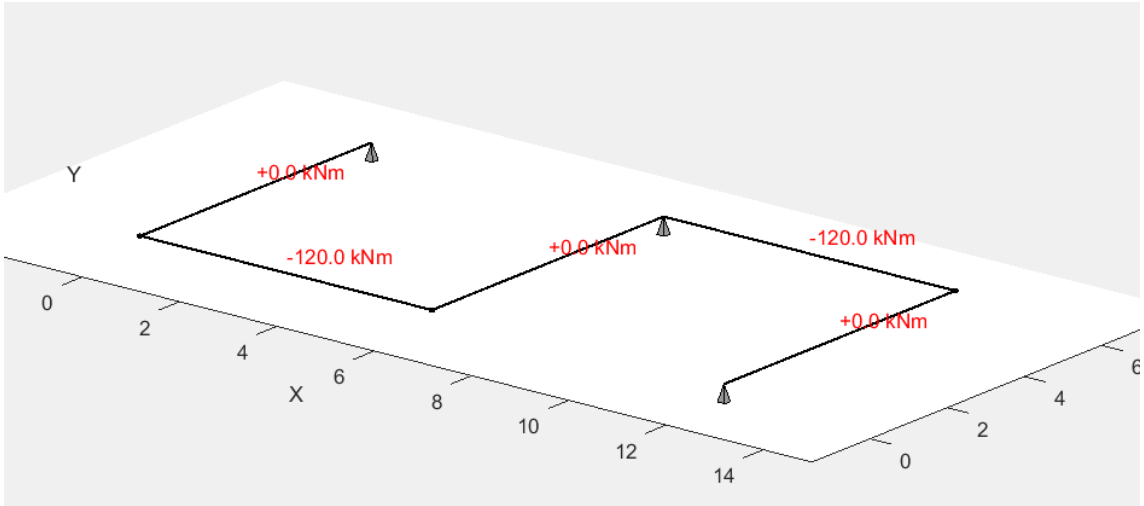


Diagrama de Momentos Torsores T_0



Caso (1) – Hiperestático X_1 isolado no Sistema Principal

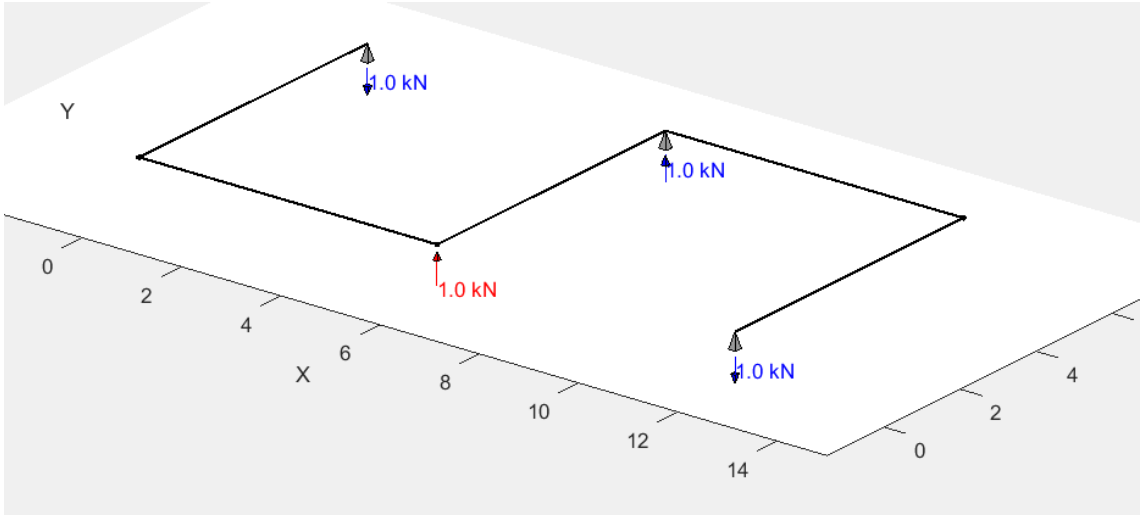


Diagrama de Momentos Fletores M_1

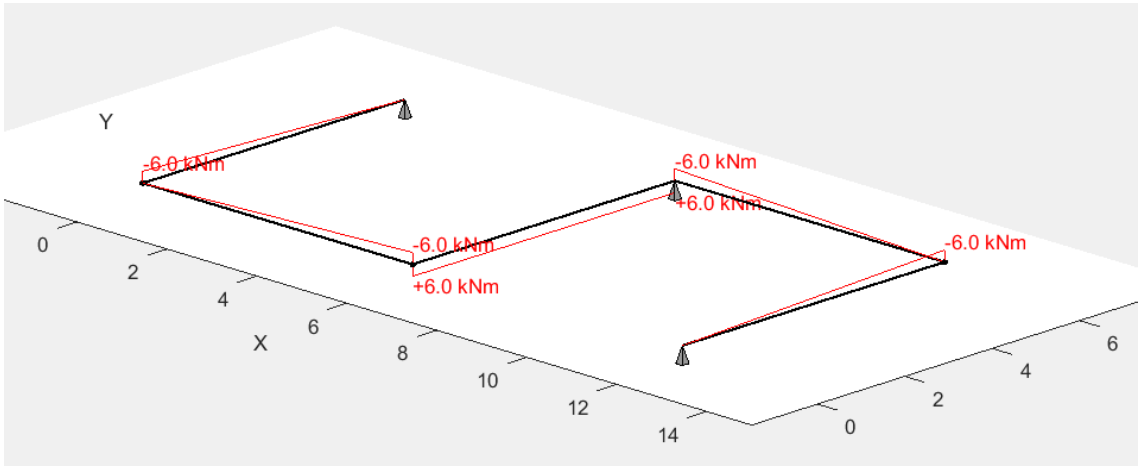
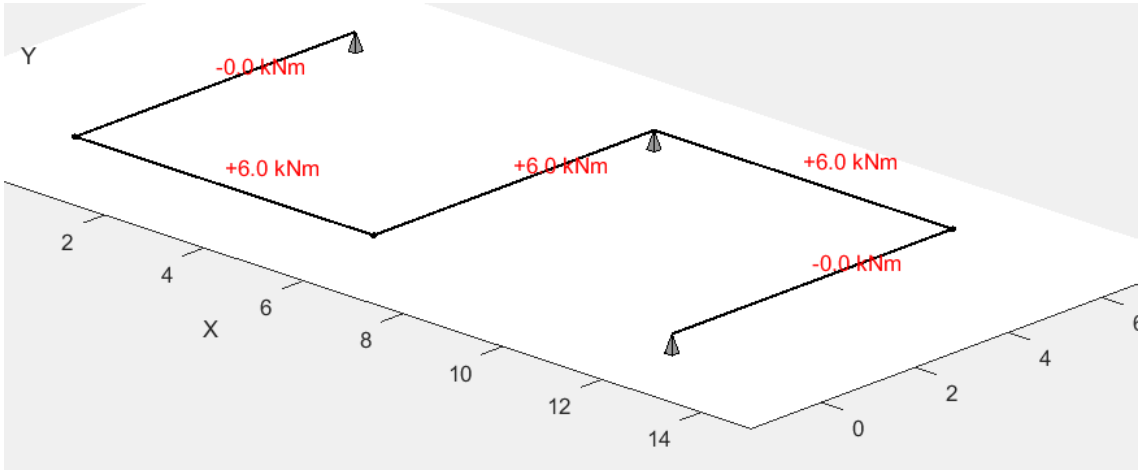
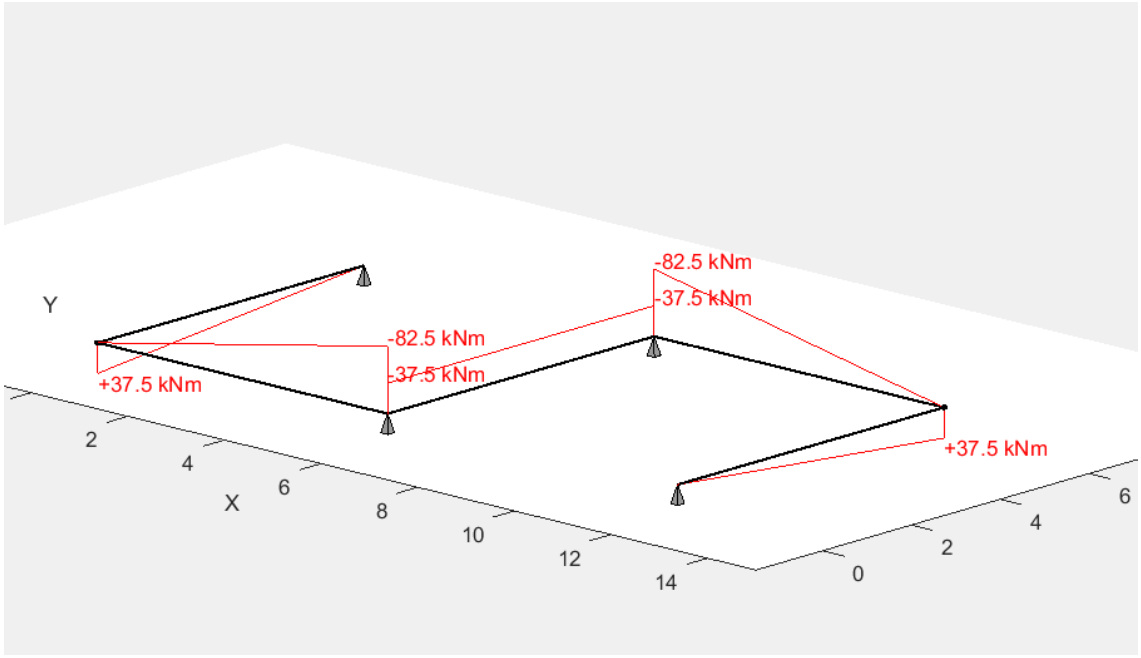


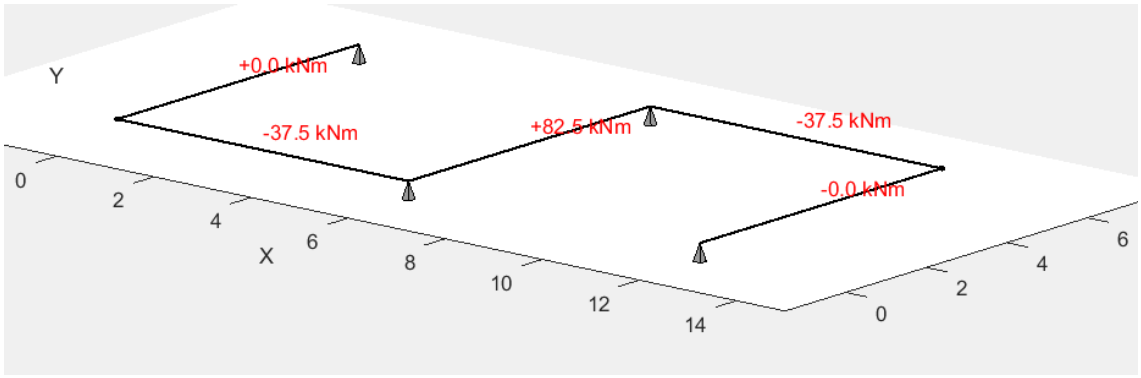
Diagrama de Momentos Torsores T_1



Momentos Fletores Finais: $M = M_0 + M_1X_1$ (kNm)



Momentos Torsores Finais: $T = T_0 + T_1X_1$ (kNm)



2ª Questão – Outra opção (3) de Sistema Principal:

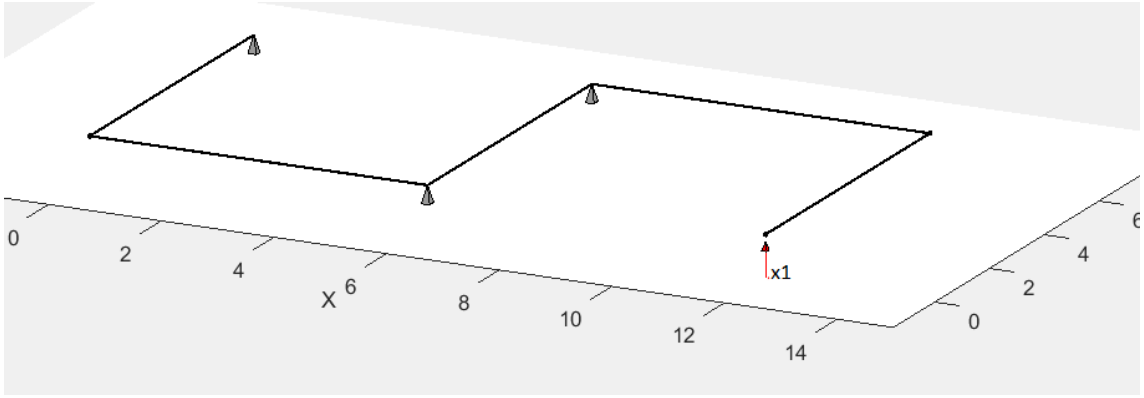


Diagrama de Momentos Fletores M_0

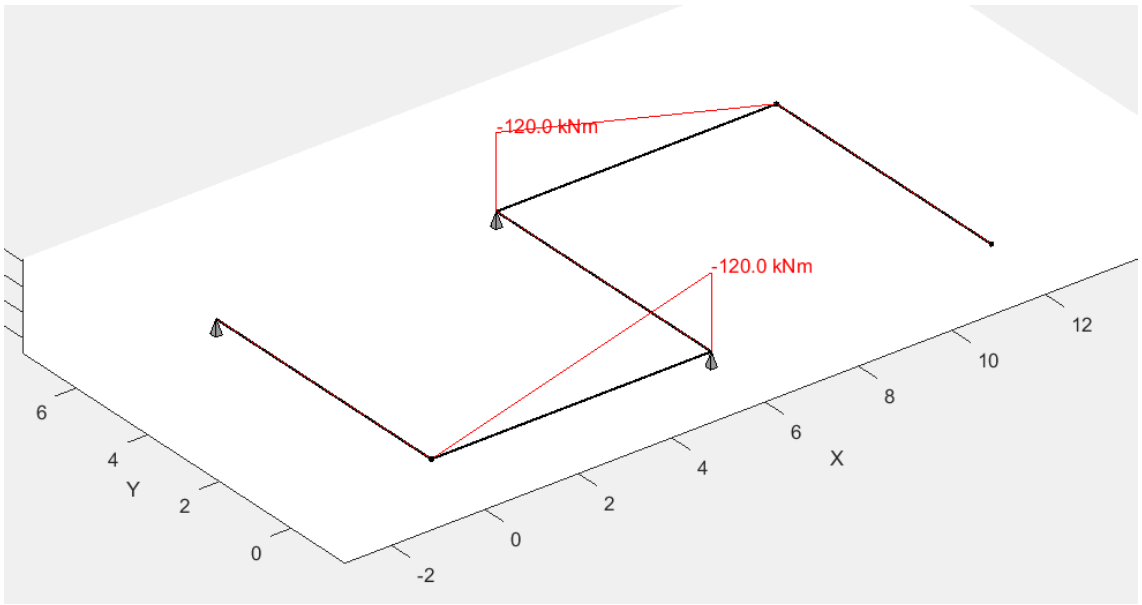
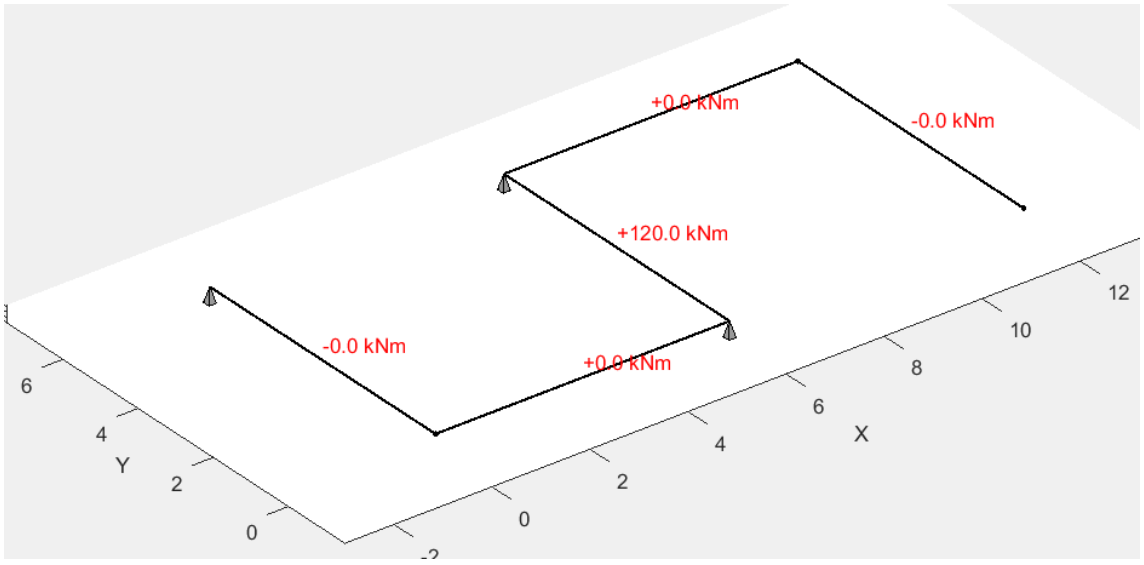


Diagrama de Momentos Torsores T_0



Caso (1) – Hiperestático X_1 isolado no Sistema Principal

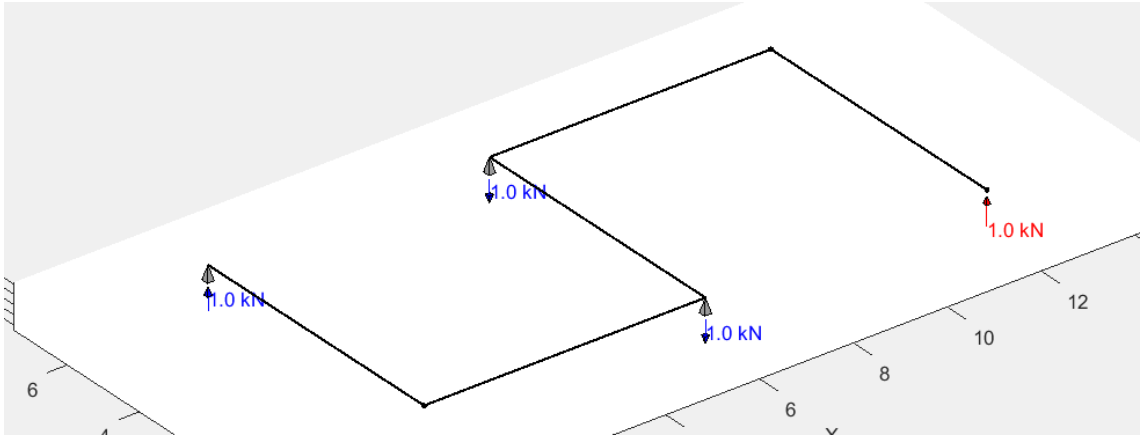


Diagrama de Momentos Fletores M_1

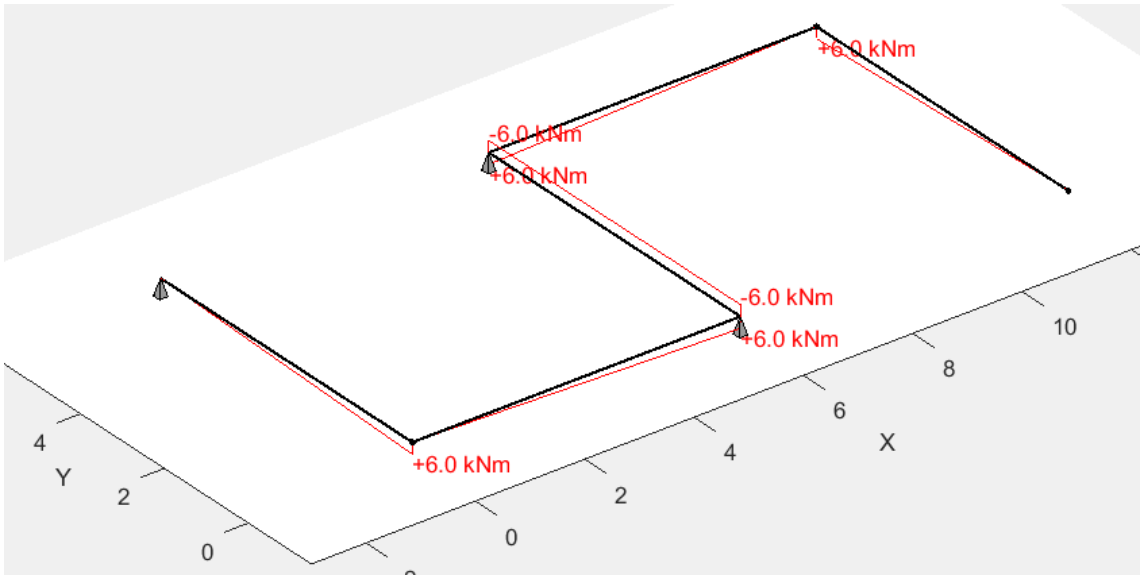
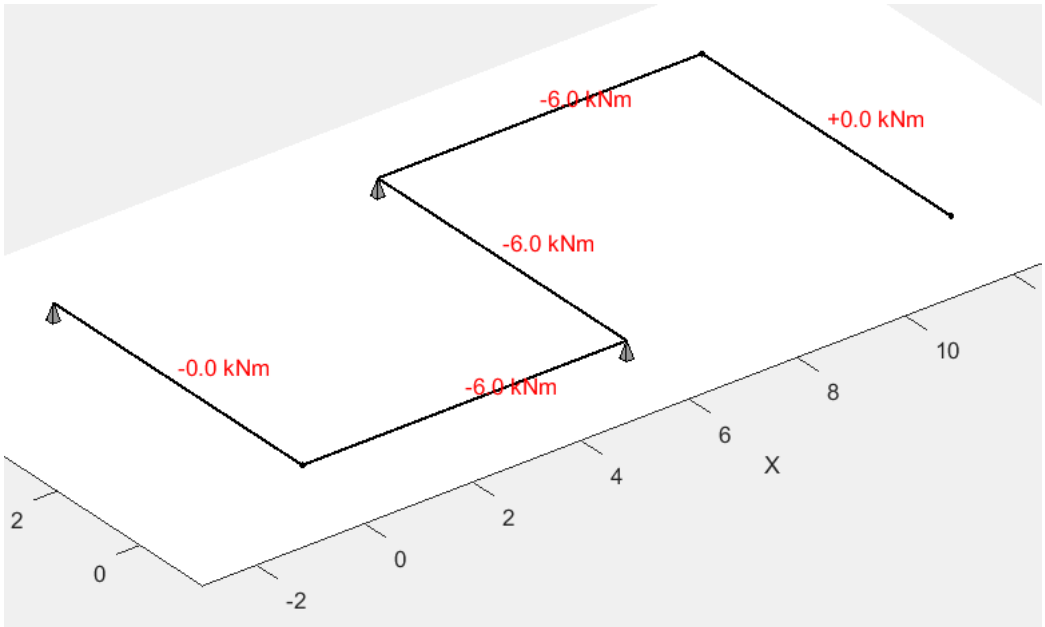
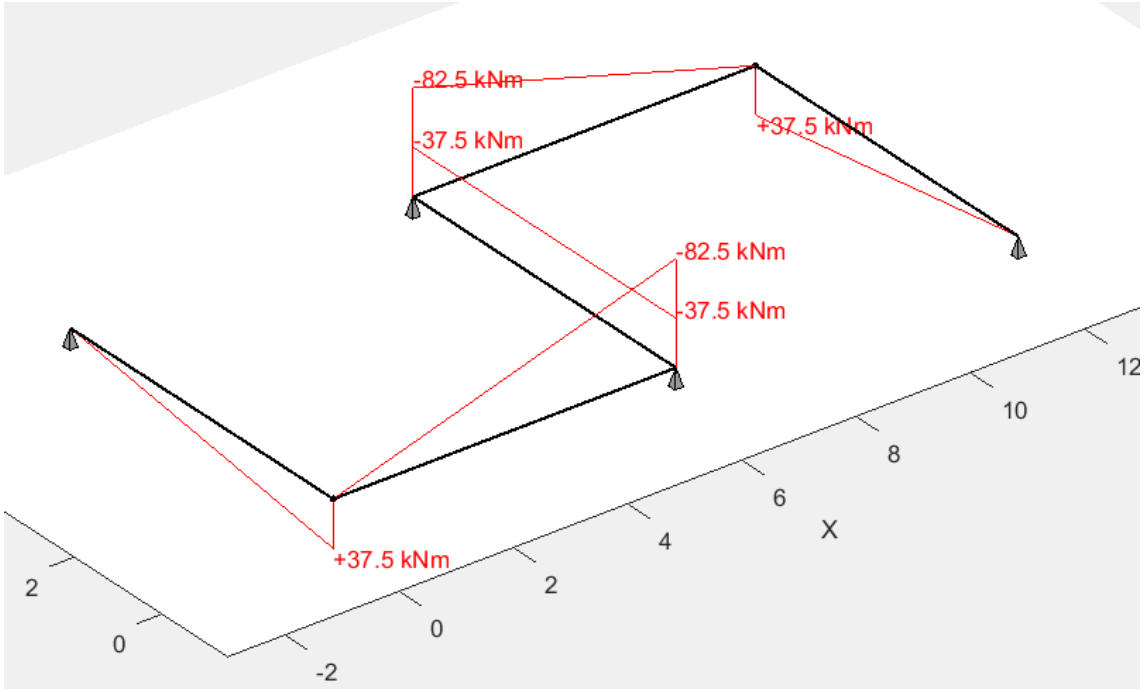


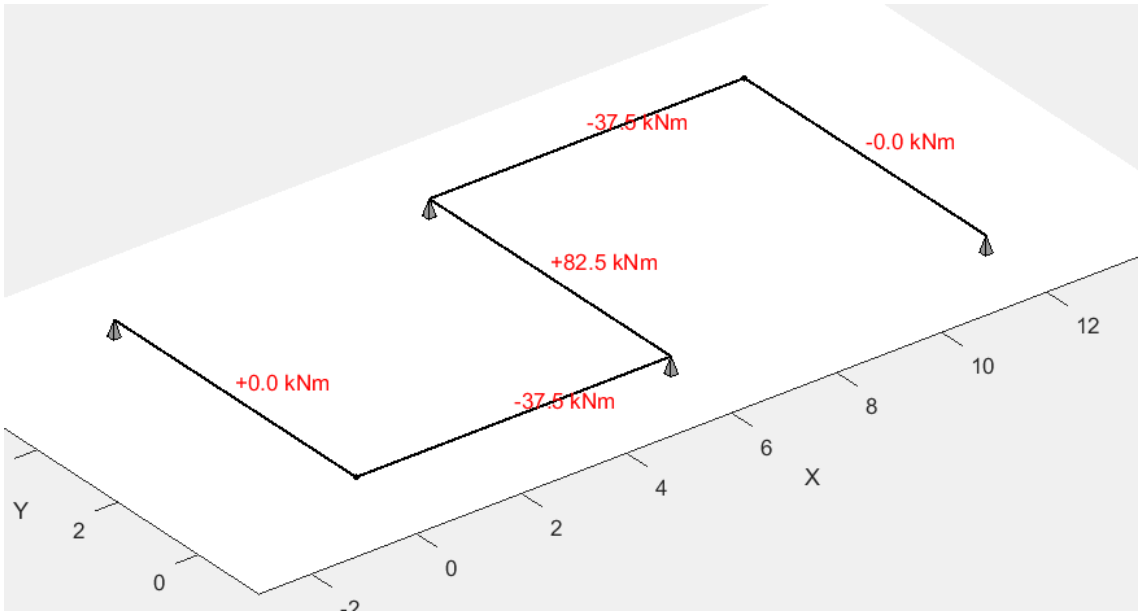
Diagrama de Momentos Torsores T_1



Momentos Fletores Finais: $M = M_0 + M_1X_1$ (kNm)



Momentos Torsores Finais: $T = T_0 + T_1X_1$ (kNm)



2ª Questão – Outra opção (2) de Sistema Principal:

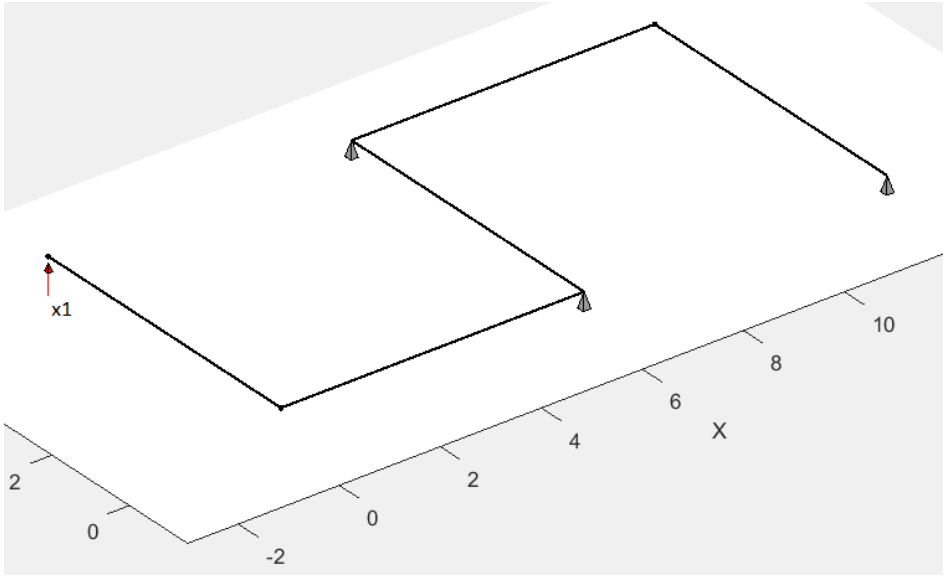


Diagrama de Momentos Fletores M_0

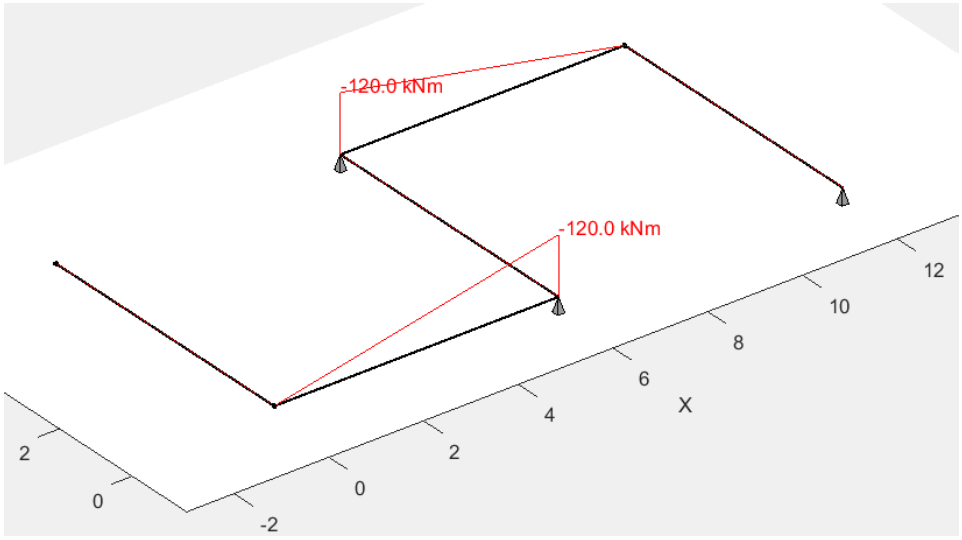
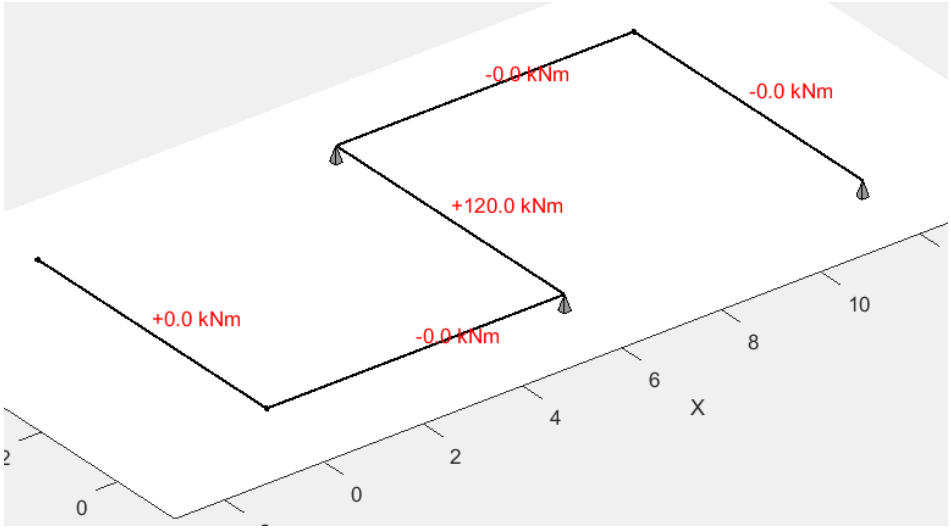


Diagrama de Momentos Torsores T_0



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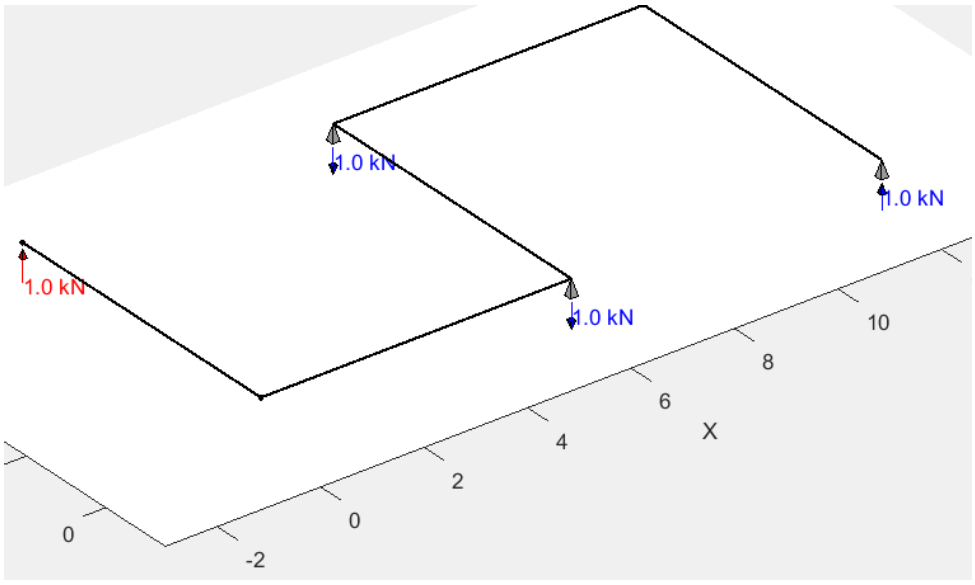


Diagrama de Momentos Fletores M_1

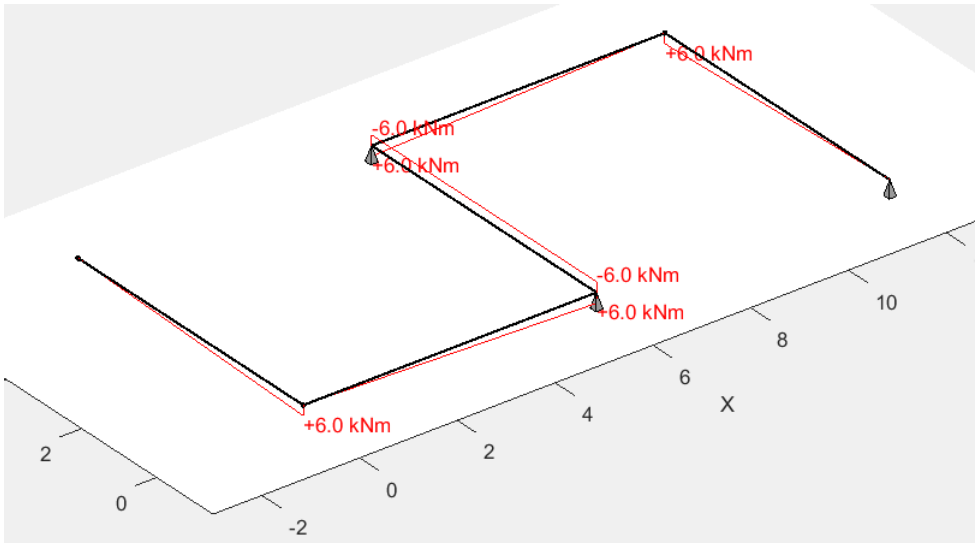
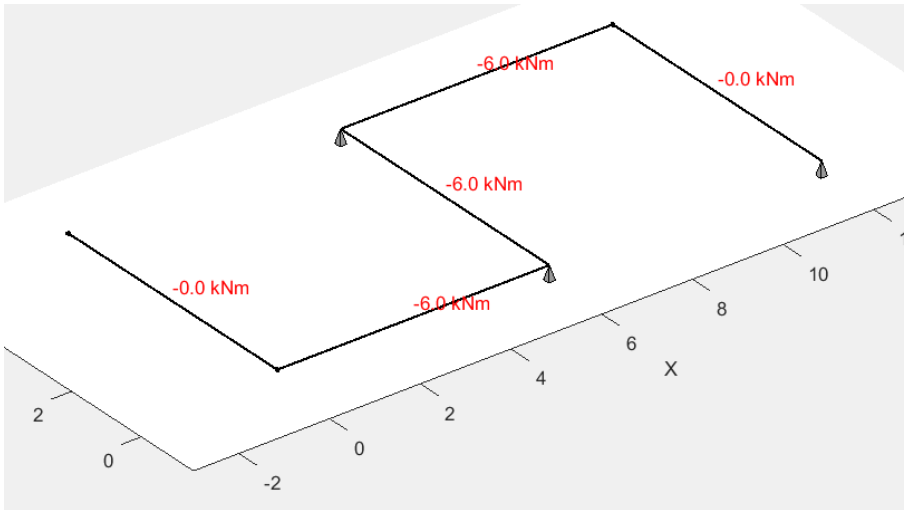
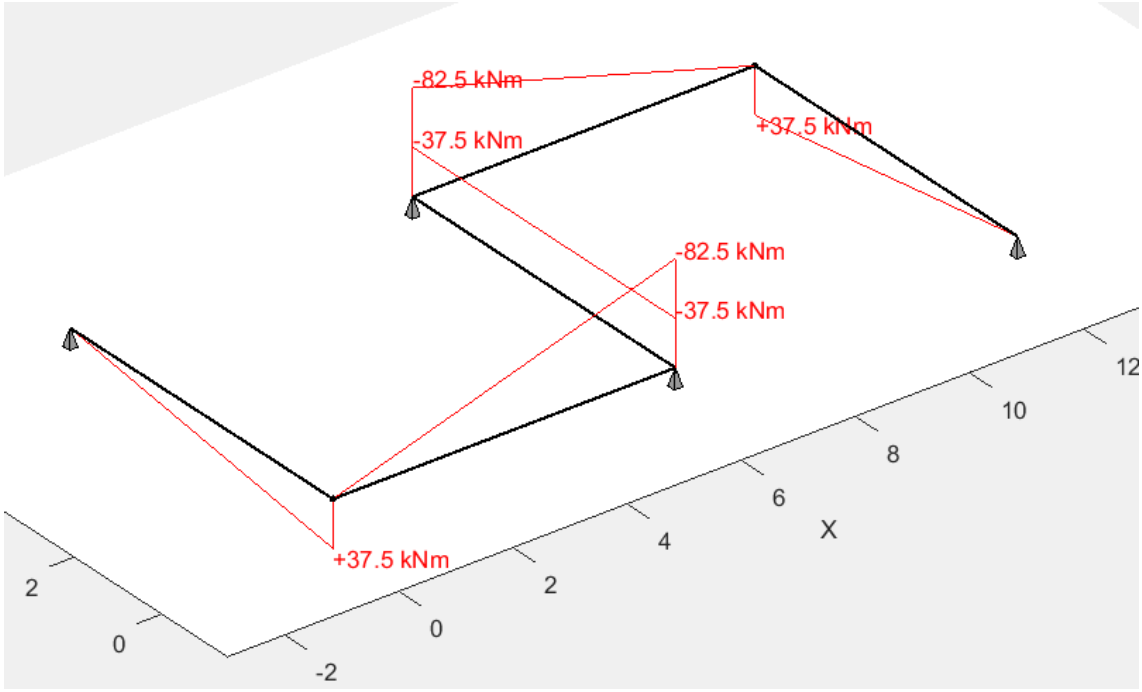


Diagrama de Momentos Torsores T_1



Momentos Fletores Finais: $M = M_0 + M_1X_1$ (kNm)



Momentos Torsores Finais: $T = T_0 + T_1X_1$ (kNm)