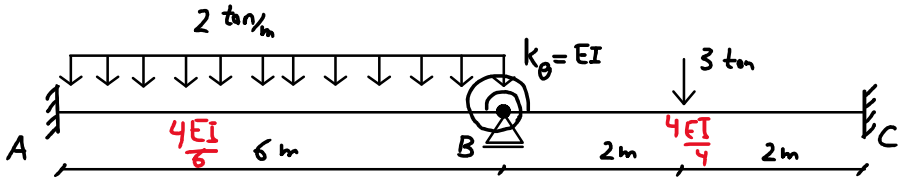
Symmetric Structures 9

Sunday, May 12, 2024 8:58

مثال : نیروی منزها را به دست آورید.



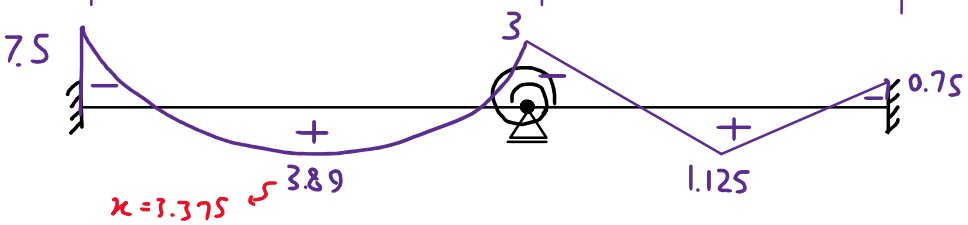
$\frac{2}{3}$, 1

1 , 1

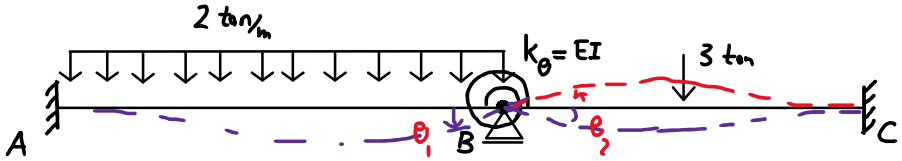
① روش توزیع لنگر

تیر	فنر	فنر	تیر
0.4	0.6	0.5	0.5

-6		6		-1.5	1.5
-1.2	←	-2.4	-3.6	3.6	
			1.05	-1.05	-1.05 → -0.53 (Cycle 1)
-0.21	←	-0.42	-0.63	0.63	
			0.31	-0.31	-0.31 → -0.16 (Cycle 2)
-0.06	←	-0.12	-0.19	0.19	
			0.1	-0.1	-0.1 → -0.05 (Cycle 3)
-0.02	←	-0.04	-0.06	0.06	
			0.03	-0.03	-0.03 → -0.02 (Cycle 4)
-0.01	←	-0.01	-0.02	0.02	
			0.01	-0.01	-0.01 → -0.01 (Cycle 5)
-7.5		3	-3	3	-3 0.75



② روش شیب - افت



$$\begin{cases} M_{BA} + M_S = 0 \\ M_{BC} + M_S = 0 \end{cases} \xrightarrow{k_\theta \Delta\theta} \begin{cases} \frac{2EI}{6}(2\theta_1) + 6 + EI(\theta_1 - \theta_2) = 0 \\ \frac{2EI}{4}(2\theta_2) - 1.5 + EI(\theta_2 - \theta_1) = 0 \end{cases} \xrightarrow{2} \begin{cases} \frac{5}{3}\theta_1 - \theta_2 = \frac{-6}{EI} \\ -\theta_1 + 2\theta_2 = \frac{1.5}{EI} \end{cases}$$

$$\begin{cases} M_{BC} + M_s = 0 \\ \frac{2EI}{4}(2\theta_2) - 1.5 + EI(\theta_2 - \theta_1) = 0 \end{cases} \rightarrow \begin{cases} -\theta_1 + 2\theta_2 = \frac{1.5}{EI} \end{cases}$$

$$\frac{7}{3}\theta_1 = \frac{-10.5}{EI} \rightarrow \boxed{\theta_1 = \frac{-4.5}{EI}} \quad \boxed{\theta_2 = \frac{-1.5}{EI}}$$

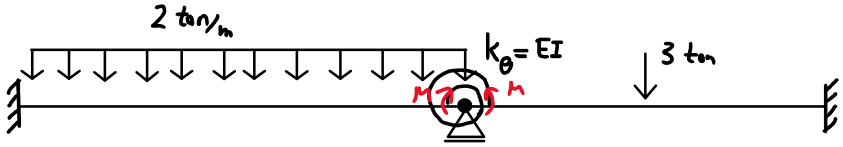
$$M_s = k_\theta \Delta\theta = EI(-4.5 + 1.5)/EI = 3$$

$$M_{AB} = \frac{2EI}{6}\left(\frac{-4.5}{EI}\right) - 6 = -7.5$$

$$M_{CB} = \frac{2EI}{4}\left(\frac{-1.5}{EI}\right) + 1.5 = 0.75$$

$$\boxed{M_s = 3} \quad \boxed{M_{AB} = -7.5} \quad \boxed{M_{CB} = 0.75}$$

③ روش سازگاری تغییر شکل ها



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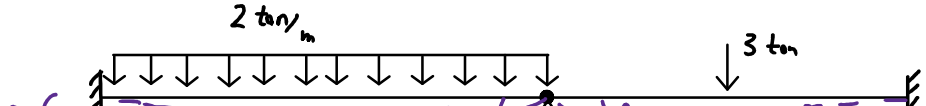
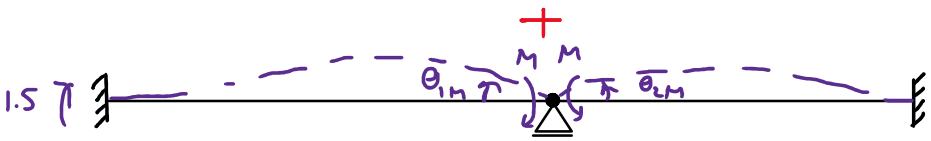


$$\frac{2EI}{6}(2\theta_{1P}) + 6 = 0 \rightarrow \theta_{1P} = \frac{-9}{EI}$$

$$\frac{2EI}{4}(2\theta_{2P}) - 1.5 = 0 \rightarrow \theta_{2P} = \frac{1.5}{EI}$$

+



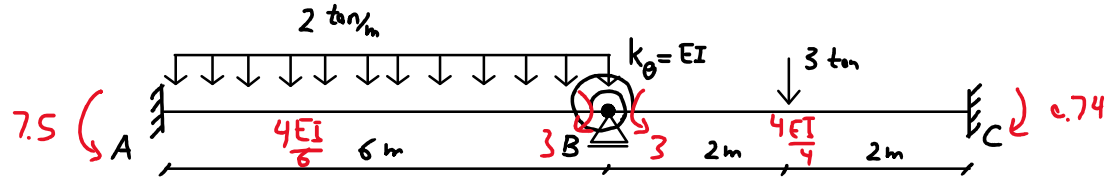
$$M = \frac{2EI}{6}(2\theta_{1M}) \rightarrow \theta_{1M} = \frac{1.5M}{EI}$$

$$\theta_{2M} = \frac{M}{EI}$$

$\Delta\theta = \frac{M}{k_\theta}$ معادله سازگاری

$$\Delta\theta = \Delta\theta_P + \Delta\theta_M = \frac{M}{k_\theta} \rightarrow \frac{10.5}{EI} - \frac{2.5M}{EI} = \frac{M}{EI} \rightarrow \boxed{M = 3}$$

④ روش توزیع لنگر برای حالت خاص



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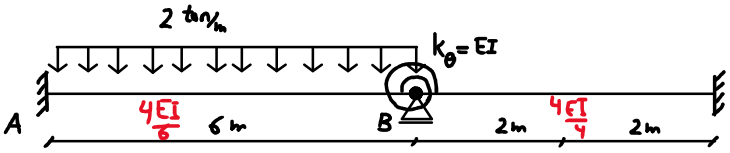

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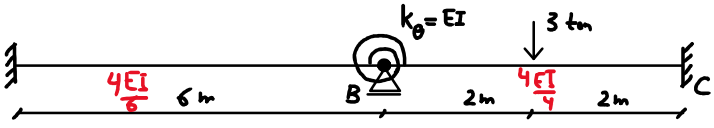


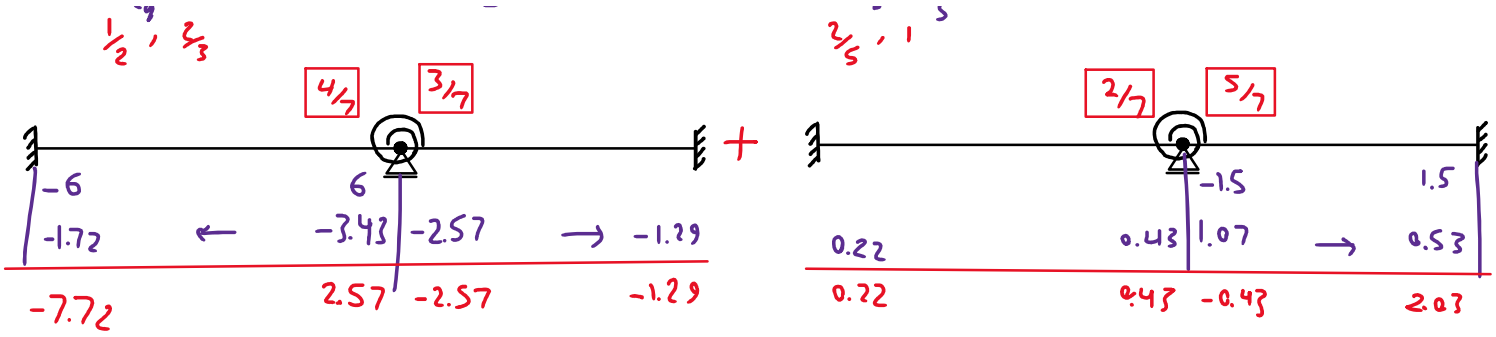
$$\frac{1}{k_{eq}} = \frac{1}{EI} + \frac{1}{EI} \rightarrow k_{eq} = \frac{EI}{2}$$

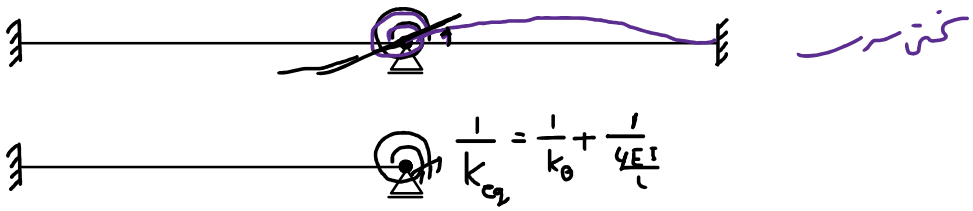
$\frac{1}{2}$, $\frac{2}{3}$

$$\frac{1}{k_{eq}} = \frac{1}{\frac{2}{3}EI} + \frac{1}{EI} \rightarrow k_{eq} = \frac{2}{5}EI$$

$\frac{2}{5}$, 1

4/ 3/ 2/ 5/


1/2 , 2/3
4/7
3/7
-6
6
-1.72
-3.43
-2.57
-1.29
-7.72
2.57
-2.57
-1.29
+
2/5 , 1
2/7
5/7
-1.5
1.5
0.22
0.43
1.07
0.53
0.22
0.43
-0.43
2.03


$\frac{1}{k_{eq}} = \frac{1}{k_\theta} + \frac{1}{\frac{4EI}{L}}$