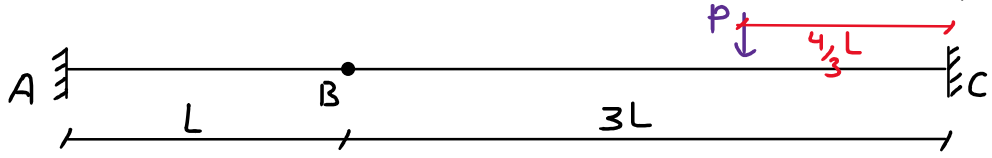
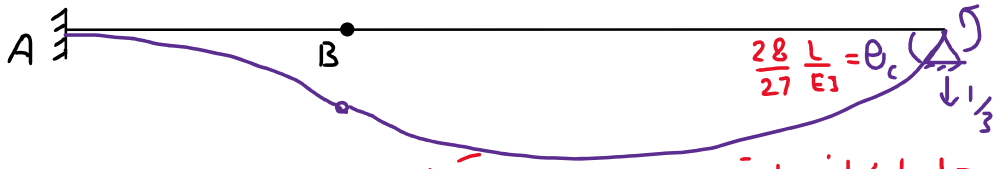
Influence Line 7

Thursday, June 13, 2024 19:03

خط تأثیر سازه‌های نامعین

مثال: حداکثر لنگر نقطه C در اثر عبور بار قائم P .

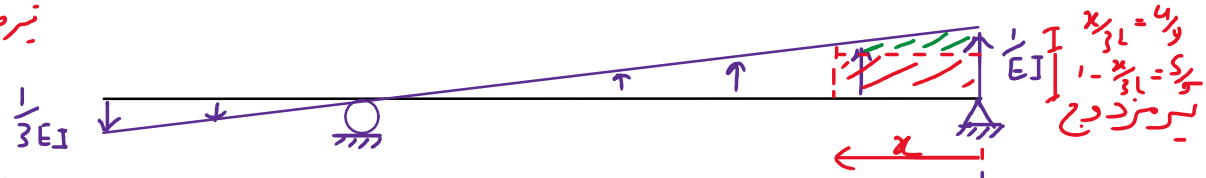




تیر اصلی

برای پیدا کردن محل بار بحرانی، از تیر مزدوج استفاده می‌کنیم.

δ_{max} تیر اصلی = M_{max} تیر مزدوج



$$\frac{1}{EI}\frac{(3L)^2}{3}+\frac{1}{3EI}\frac{L^2}{3}-R_c(3L)=0 \rightarrow R_c=\frac{28}{27}\frac{L}{EI}$$

$$M_{max} \rightarrow V=0 \rightarrow -\frac{28}{27}\frac{L}{EI}+\frac{1}{2EI}\left[1+1-\frac{x}{3L}\right]x=0 \rightarrow x-\frac{x^2}{6L}=\frac{28}{27}L \rightarrow x^2-(6L)x+\frac{56}{9}L^2=0$$

$$x=\frac{4}{3}L$$

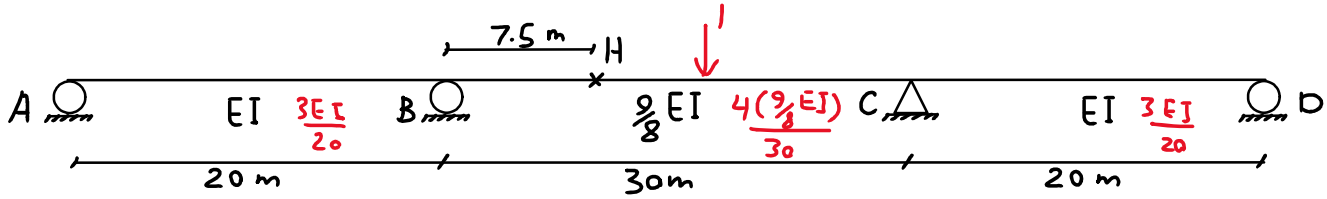
$$M_{max}=-\frac{28}{27}\frac{L}{EI}\left(\frac{4}{3}L\right)+\frac{5}{9EI}\frac{\left(\frac{4}{3}L\right)^2}{2}+\frac{4}{9EI}\frac{\left(\frac{4}{3}L\right)^3}{3}=-0.626\frac{L^2}{EI}$$

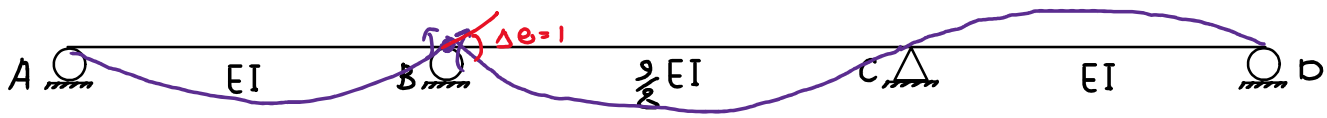
δ_{max} تیر اصلی = M_{max} تیر مزدوج

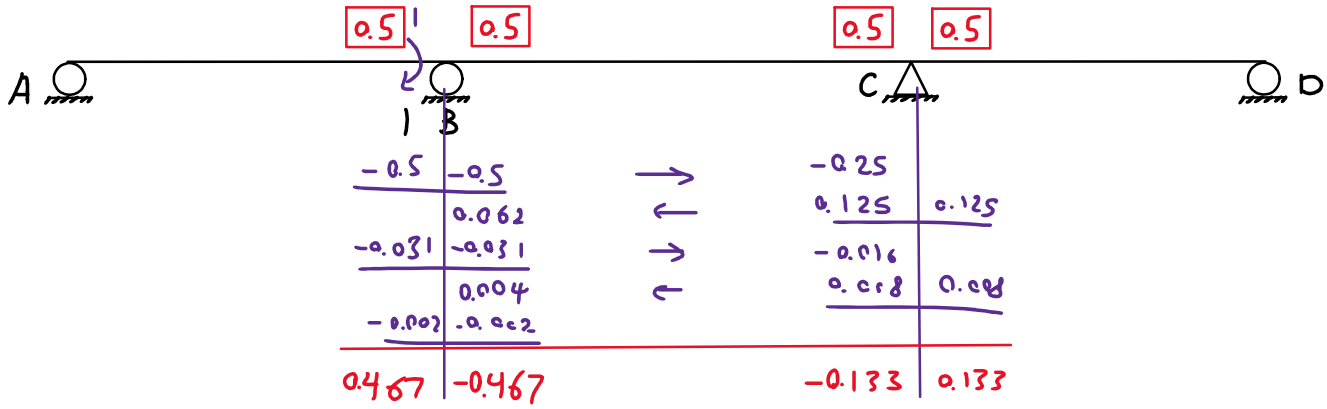
$$M_c=\frac{\delta_{max}}{\theta_c}=\frac{-0.626\frac{L^2}{EI}}{\frac{28}{27}\frac{L}{EI}}=-0.603L$$

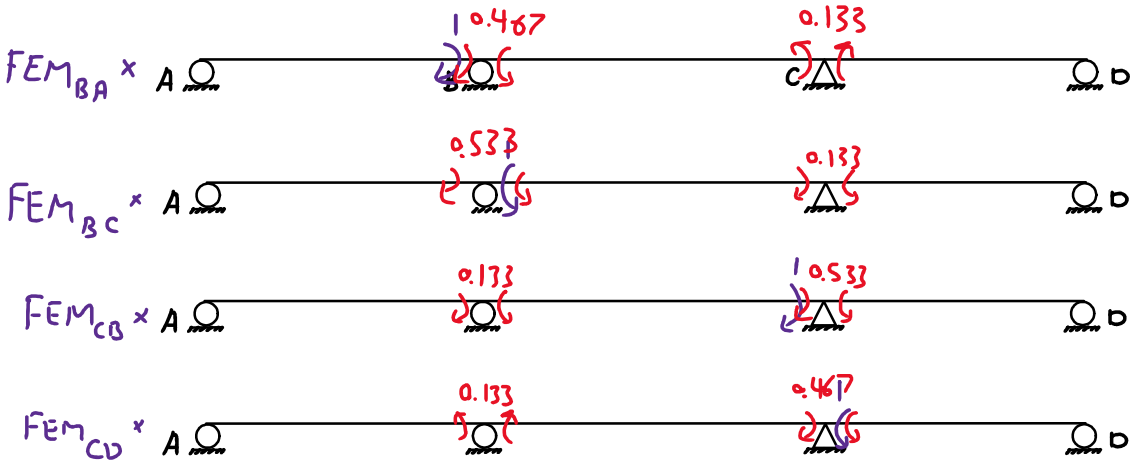
$$M_{c,max}=-0.603PL$$

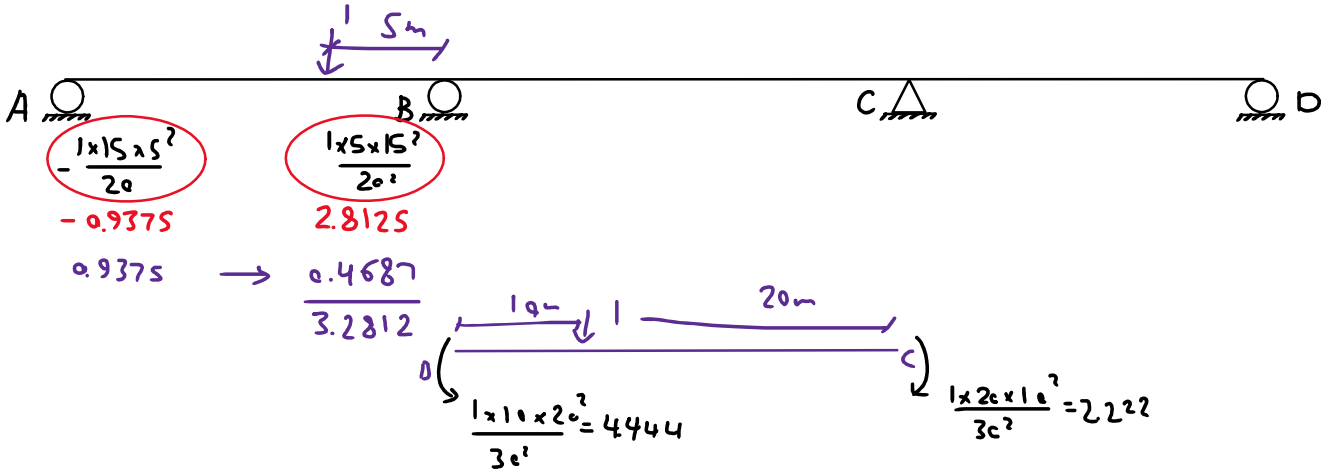
مثال: مقدار عددی خط تأثیر تیر پیوسته شکل زیر را برای M_B، M_c، V_H و V_{BR} به صورت کامل به دست آورید.



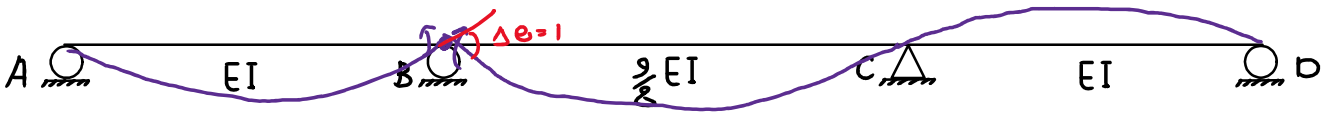


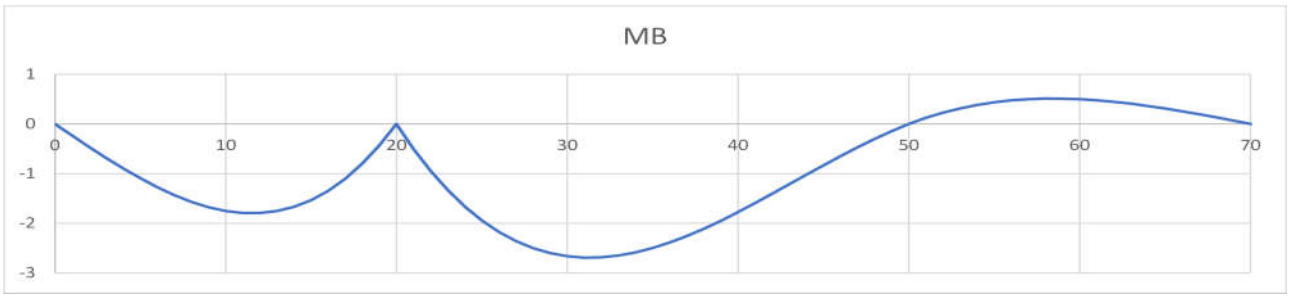


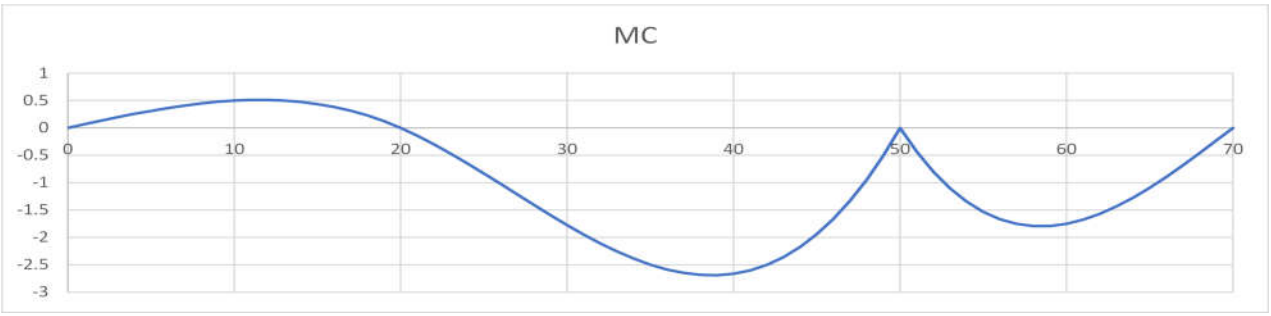


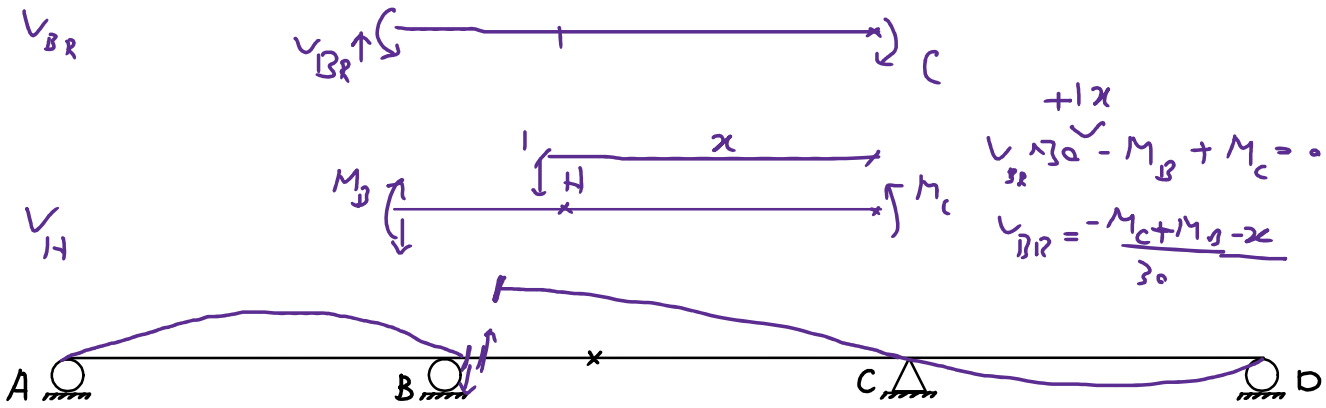


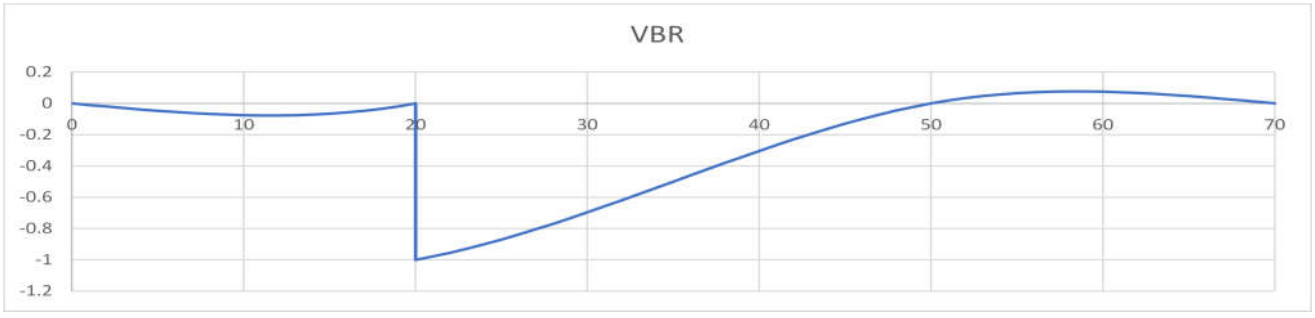
$$M_a = 4.444 \times 0.533 + 2.222 \times 0.133$$











Loc (m)	M_B	M_C	V_BR
0	**0**	0	0
1	-0.23292	0.066334	-0.00998
2	-0.46233	0.13167	-0.0198
3	-0.68474	0.195011	-0.02933
4	-0.89664	0.25536	-0.0384
5	-1.09453	0.311719	-0.04688
6	-1.27491	0.36309	-0.0546
7	-1.43427	0.408476	-0.06143

4	-0.89664	0.25536	-0.0384
5	-1.09453	0.311719	-0.04688
6	-1.27491	0.36309	-0.0546
7	-1.43427	0.408476	-0.06143
8	-1.56912	0.44688	-0.0672
9	-1.67595	0.477304	-0.07178
10	-1.75125	0.49875	-0.075
11	-1.79153	0.510221	-0.07673
12	-1.79328	0.51072	-0.0768
13	-1.753	0.499249	-0.07508
14	-1.66719	0.47481	-0.0714
15	-1.53234	0.436406	-0.06563
16	-1.34496	0.38304	-0.0576
17	-1.10154	0.313714	-0.04718
18	-0.79857	0.22743	-0.0342
19	-0.43256	0.123191	-0.01853
20	0	0	0
20	0	0	-1
21	-0.50234	-0.14146	-0.9787
22	-0.94516	-0.29804	-0.9549
23	-1.3311	-0.4671	-0.9288
24	-1.66284	-0.64596	-0.90056
25	-1.94306	-0.83194	-0.87037
26	-2.1744	-1.0224	-0.8384
27	-2.35954	-1.21466	-0.80483
28	-2.50116	-1.40604	-0.76984
29	-2.6019	-1.5939	-0.7336
30	-2.66444	-1.77556	-0.6963
31	-2.69146	-1.94834	-0.6581
32	-2.6856	-2.1096	-0.6192
33	-2.64954	-2.25666	-0.57976
34	-2.58596	-2.38684	-0.53997
35	-2.4975	-2.4975	-0.5
36	-2.38684	-2.58596	-0.46003
37	-2.25666	-2.64954	-0.42024
38	-2.1096	-2.6856	-0.3808
39	-1.94834	-2.69146	-0.3419
40	-1.77556	-2.66444	-0.3037
41	-1.5939	-2.6019	-0.2664
42	-1.40604	-2.50116	-0.23016
43	-1.21466	-2.35954	-0.19517
44	-1.0224	-2.1744	-0.1616
45	-0.83194	-1.94306	-0.12963
46	-0.64596	-1.66284	-0.09944
47	-0.4671	-1.3311	-0.0712
48	-0.29804	-0.94516	-0.0451
49	-0.14146	-0.50234	-0.0213
50	0	0	0
51	0.123191	-0.43256	0.018525
52	0.22743	-0.79857	0.0342
53	0.313714	-1.10154	0.047175
54	0.38304	-1.34496	0.0576
55	0.436406	-1.53234	0.065625
56	0.47481	-1.66719	0.0714
57	0.499249	-1.753	0.075075
58	0.51072	-1.79328	0.0768
59	0.510221	-1.79153	0.076725
60	0.49875	-1.75125	0.075
61	0.477304	-1.67595	0.071775
62	0.44688	-1.56912	0.0672
63	0.408476	-1.43427	0.061425
64	0.36309	-1.27491	0.0546
65	0.311719	-1.09453	0.046875
66	0.25536	-0.89664	0.0384
67	0.195011	-0.68474	0.029325
68	0.13167	-0.46233	0.0198
69	0.066334	-0.23292	0.009975
70	0	0	0