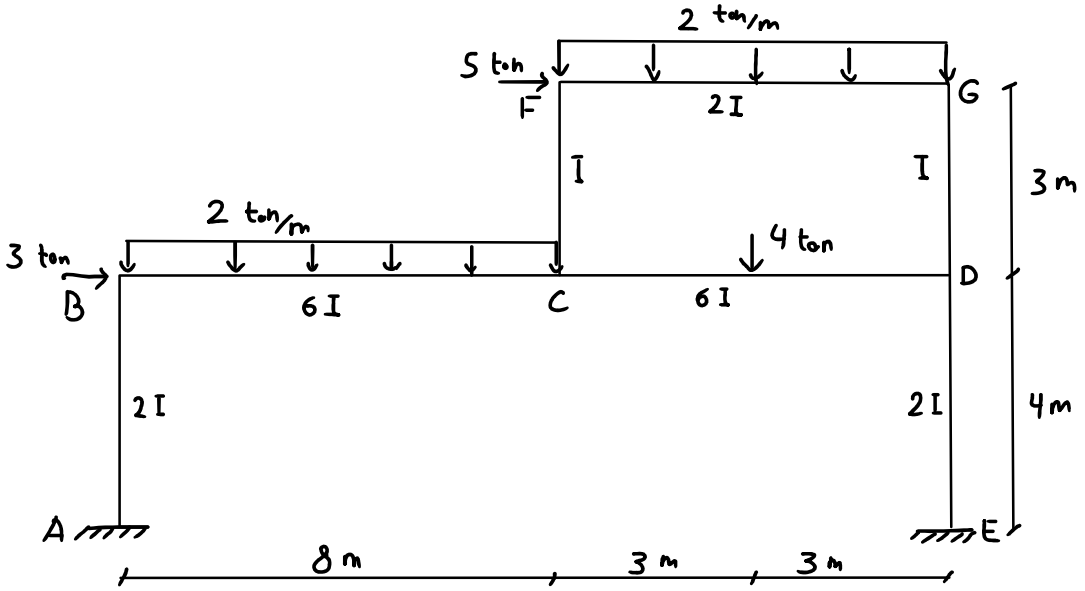
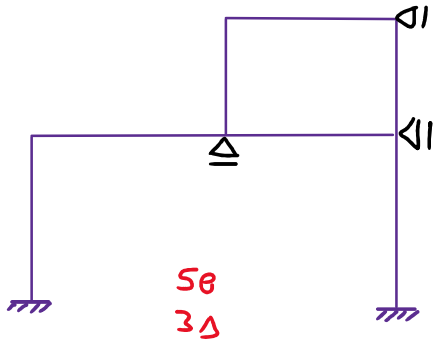
مثال: قاب شکل زیر را به روش شیب - انت تحلیل کنید.



$\frac{WL^2}{12} = \frac{2\times 6^2}{12} = 6$

$\frac{WL^2}{12} = \frac{2\times 8^2}{12} = 10.67$

$\frac{PL}{8} = \frac{4\times 6}{8} = 3$



$M_{AB} = \frac{2(2EI)}{4}\left(\theta_B - 3\frac{\Delta_2}{4}\right)$

$M_{BA} = \frac{2(2EI)}{4}\left(2\theta_B - 3\frac{\Delta_2}{4}\right)$

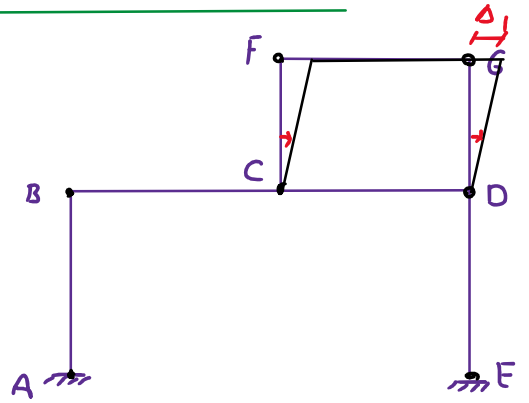
$M_{ED} = \frac{2(2EI)}{4}\left(\theta_D - 3\frac{\Delta_2}{4}\right)$

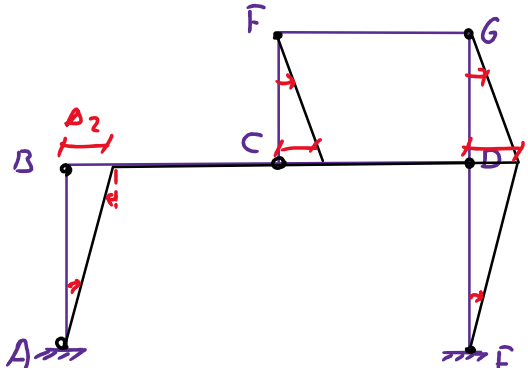
$M_{DE} = \frac{2(2EJ)}{4}\left(2\theta_D - 3\frac{\Delta_2}{4}\right)$

$M_{CF} = \frac{2(EI)}{3}\left(2\theta_C + \theta_F - 3\frac{\Delta_1}{3} + 3\frac{\Delta_2}{3}\right)$

$M_{FC} = \frac{2EI}{3}\left(2\theta_F + \theta_C - 3\frac{\Delta_1}{3} + 3\frac{\Delta_2}{3}\right)$

$M_{DG} = \frac{2EI}{3}\left(2\theta_D + \theta_G - 3\frac{\Delta_1}{3} + 3\frac{\Delta_2}{3}\right)$





$$M_{DG} = \frac{2EI}{3}\left(2\theta_D + \theta_G - 3\frac{\Delta_1}{3} + 3\frac{\Delta_2}{3}\right)$$

$$M_{GD} = \frac{2EI}{3}\left(2\theta_G + \theta_D - 3\frac{\Delta_1}{3} + 3\frac{\Delta_2}{3}\right)$$

$$M_{BC} = \frac{2(6EI)}{8}\left(2\theta_B + \theta_C - 3\frac{\Delta_3}{8}\right) - 10.67$$

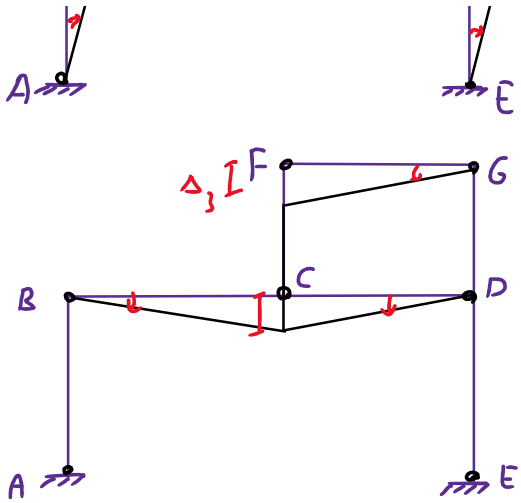
$$M_{CB} = \frac{2(6EI)}{8}\left(2\theta_C + \theta_B - 3\frac{\Delta_3}{8}\right) + 10.67$$

$$M_{CD} = \frac{2(6EI)}{6}\left(2\theta_C + \theta_D + 3\frac{\Delta_3}{6}\right) - 3$$

$$M_{DC} = \frac{2(6EI)}{6}\left(2\theta_D + \theta_C + 3\frac{\Delta_3}{6}\right) + 3$$

$$M_{FG} = \frac{2(2EI)}{6}\left(2\theta_F + \theta_G + 3\frac{\Delta_3}{6}\right) - 6$$

$$M_{GF} = \frac{2(2EI)}{6}\left(2\theta_G + \theta_F + 3\frac{\Delta_3}{6}\right) + 6$$



① $M_{BA} + M_{BC} = 0$

② $M_{CB} + M_{CD} + M_{CF} = 0$

③ $M_{DE} + M_{DC} + M_{DG} = 0$

④ $M_{FC} + M_{FG} = 0$

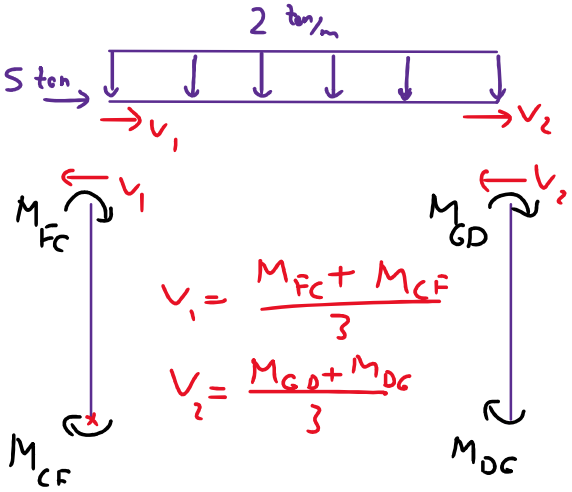
⑤ $M_{GD} + M_{GF} = 0$

⑥ $M_{FC} + M_{CF} + M_{GD} + M_{DG} + 15 = 0$

⑦ $3(M_{AB} + M_{DA} + M_{DE} + M_{ED}) - 4(M_{FC} + M_{CF} + M_{GD} + M_{DG}) + 36 = 0$

⑧ $4(M_{FG} + M_{GF} + M_{CD} + M_{DC}) - 3(M_{CB} + M_{BC}) - 320 = 0$

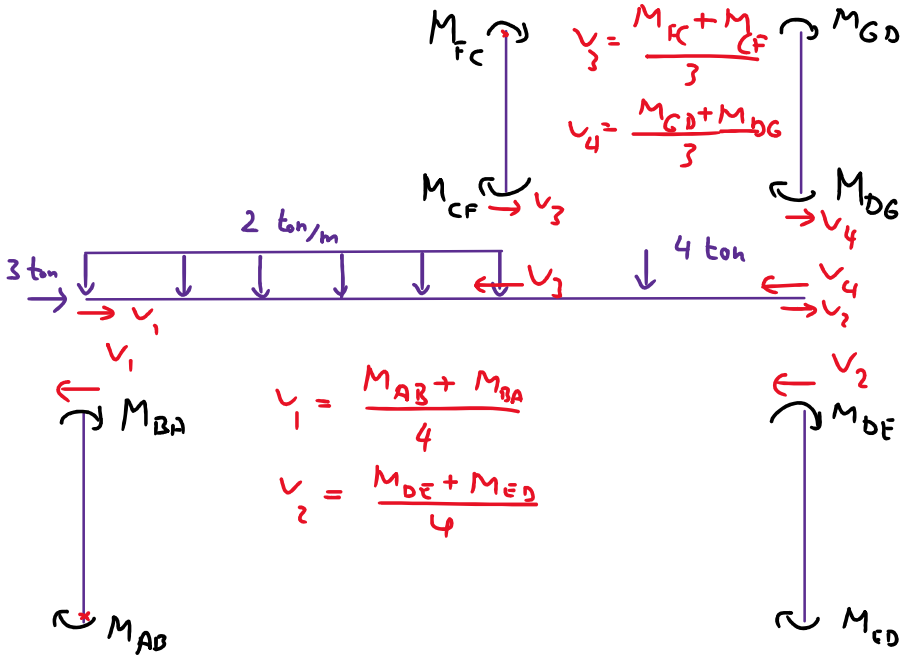
2 unknowns



$$V_1 = \frac{M_{FC} + M_{CF}}{3}$$

$$V_2 = \frac{M_{GD} + M_{DG}}{3}$$

⑥ $V_1 + V_2 + 5 = 0$



$$V_3 = \frac{M_{FC} + M_{CF}}{3}$$

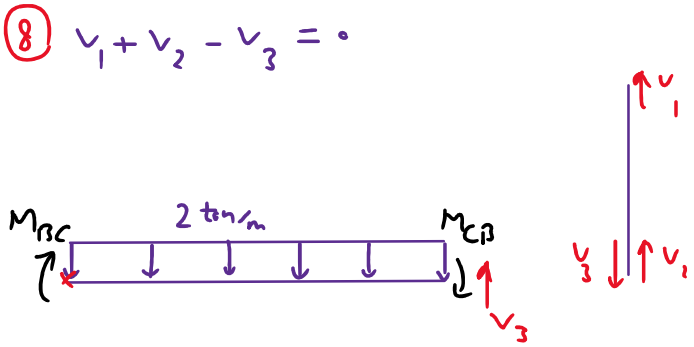
$$V_4 = \frac{M_{GD} + M_{DG}}{3}$$

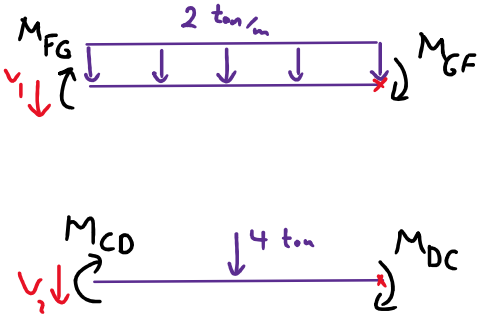
⑦ $V_1 + V_2 - V_3 - V_4 + 3 = 0$

$$V_1 = \frac{M_{AB} + M_{BA}}{4}$$

$$V_2 = \frac{M_{DE} + M_{ED}}{4}$$

⑧ $V_1 + V_2 - V_3 = 0$





$$V_1 = \frac{1}{6}\left[M_{FG} + M_{GF} - 2(6)(3)\right] \quad (36)$$

$$V_2 = \frac{1}{6}\left[M_{CD} + M_{DC} - 4(3)\right] \quad (12)$$

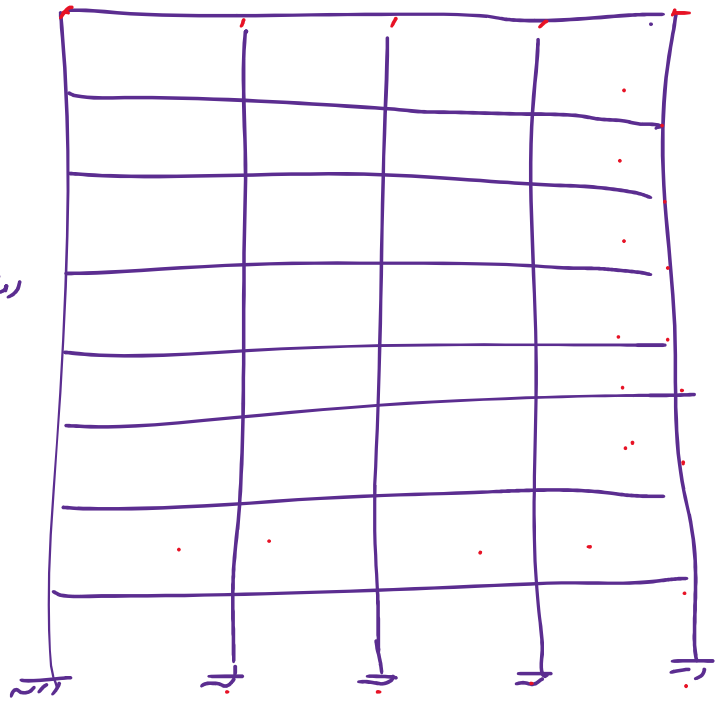
$$V_2 = \frac{1}{6}\left[M_{CD} + M_{DC} - \overset{12}{4}(3)\right]$$

$$V_3 = \frac{1}{8}\left[M_{CB} + M_{BC} + 2\overset{64}{(8)}(4)\right]$$

مقایسه‌ی

تعداد مجهولات و معادلات

به روش شیب و دیر



$\frac{\partial U}{\partial M_1} = 0$

$\int \frac{M}{EI}\frac{\partial M}{\partial M_1} dx = 0$

روش سازگاری ← تغییر شکل ها و روش کاستیلیانو

$(28+4) \times 3 = \boxed{96}$

(8×5) 0

8 5

روش شیب - افت

$\boxed{48}$