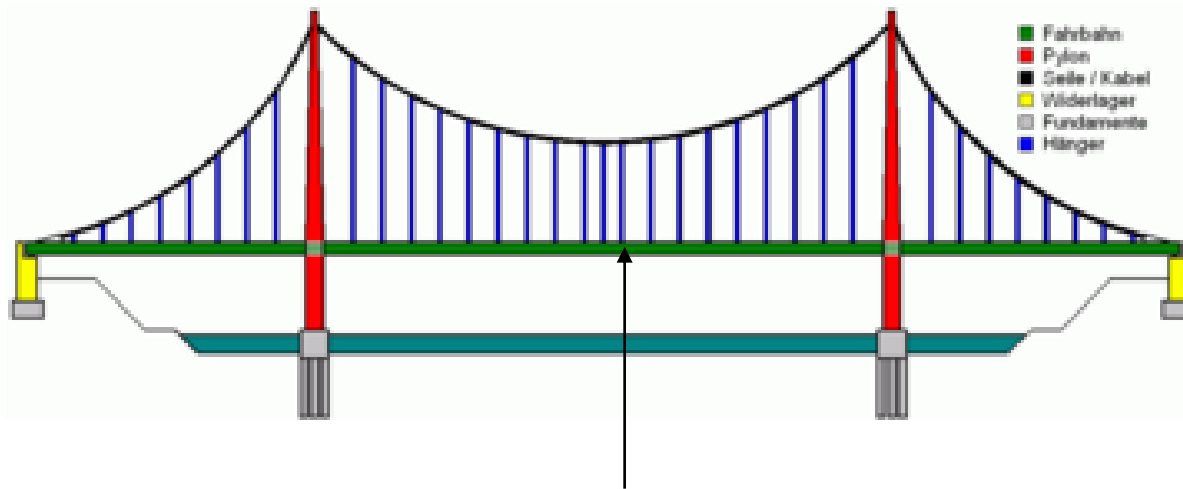


OVJEŠENI I PODUPRTI SUSTAVI



Složeni sustavi: kruti dio iz dvije grede

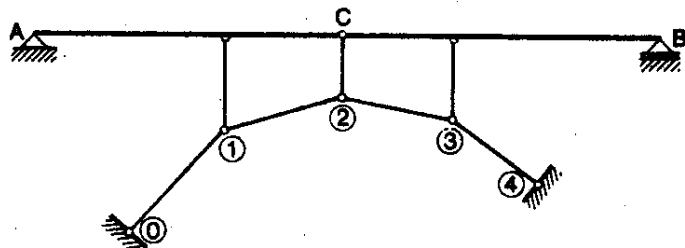
štapovi podupore/

štapovi ovjesa

PRIMJENA: primarno kod mostova

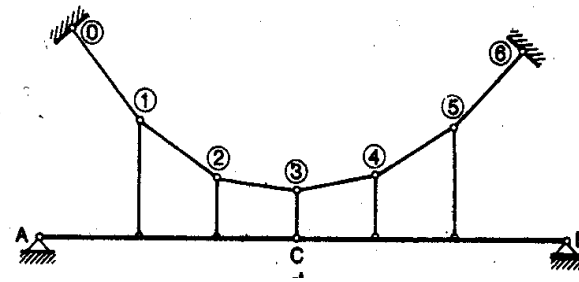


OVJEŠENI I PODUPRTI SUSTAVI



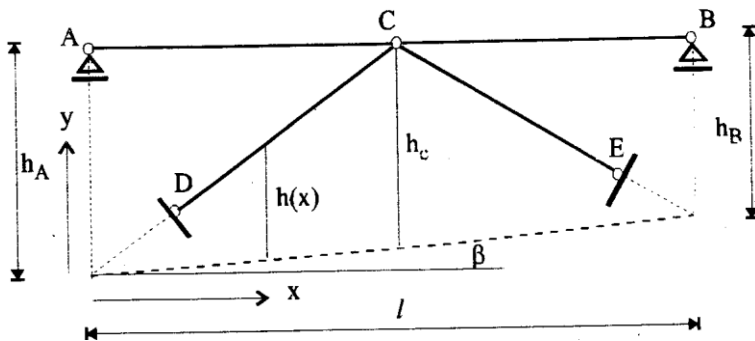
PODUPRTI SUSTAVI

Štapovi podupore tlačni

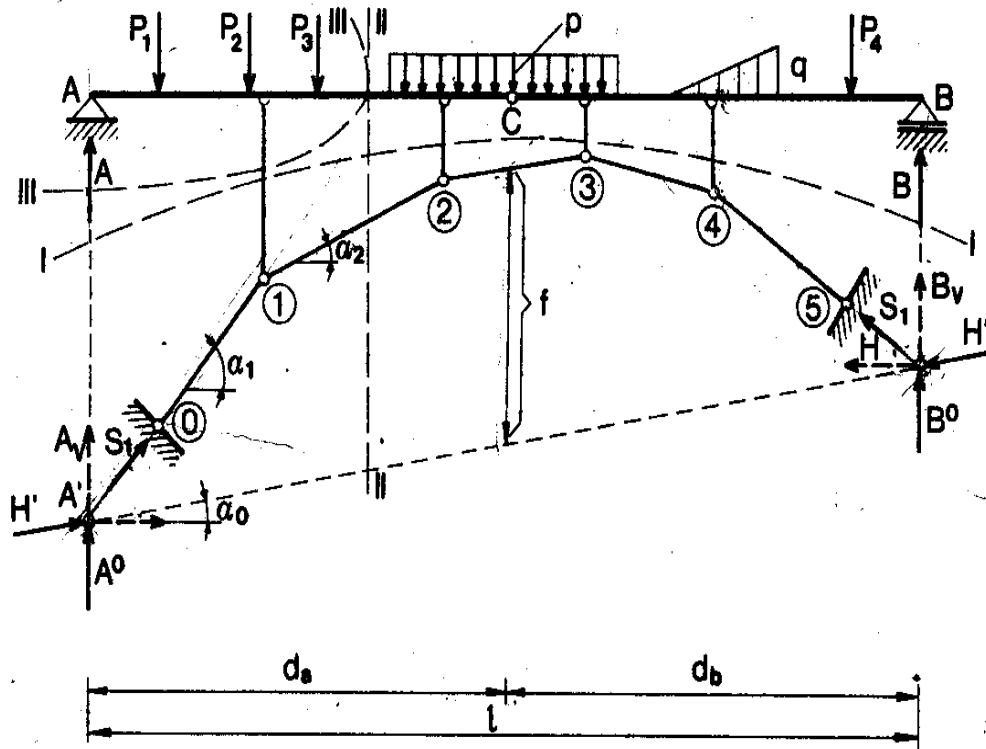


OVJEŠENI SUSTAV

Štapovi ovjesa vlačni



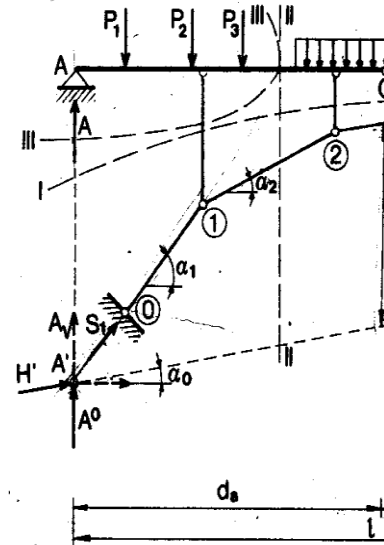
PODUPRTI SUSTAVI



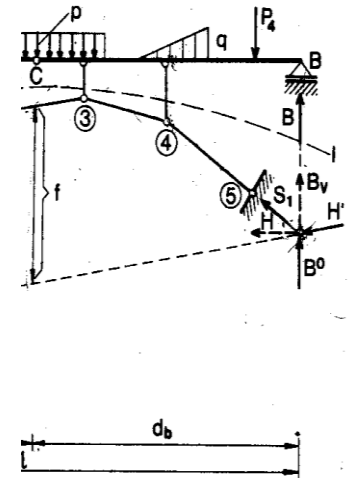
$$S = 3 \cdot 11 - 2 \cdot 5 - 4 \cdot 4 - 7 = 0$$

NUŽAN UVJET G.N. ✓

DI



DII



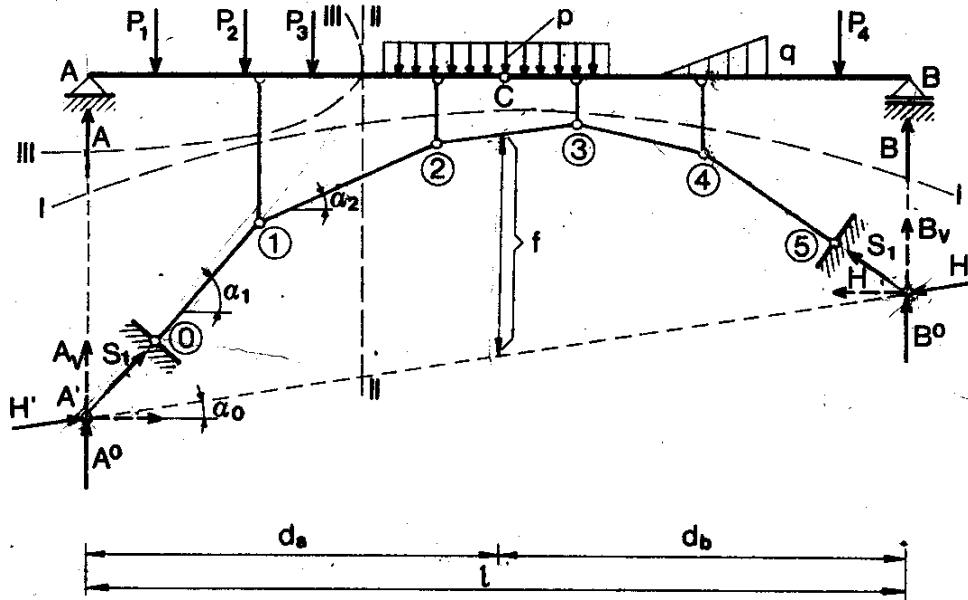
DOVOLJAN UVJET:

C 23 ✓

A S1 ✓

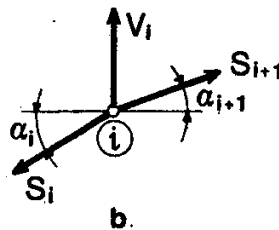
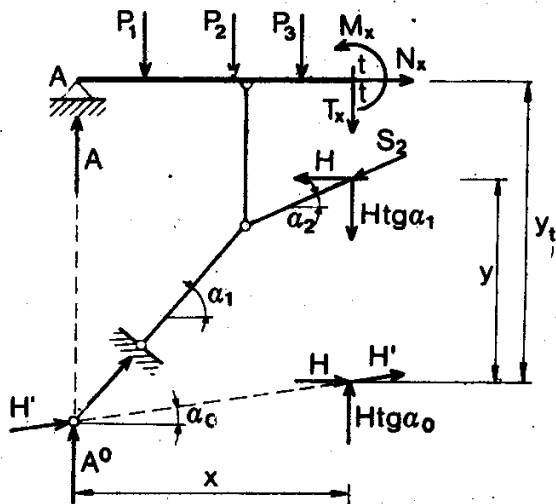
B S5 ✓

Poduprti sustav



Rezultante reakcija: A S_1 ; B S_5 \Rightarrow

Uvodi se analogija trozglobnog lučn. sustava.



U svim štapovima podupore horizontalne komponente S_i su iste.

Poduprti sustav

Reakcije :

$$\begin{bmatrix} A \\ S_1 \end{bmatrix} = \begin{bmatrix} H' \\ A^0 \end{bmatrix} \left. \vphantom{\begin{bmatrix} A \\ S_1 \end{bmatrix}} \right\}$$

$$\begin{bmatrix} B \\ S_5 \end{bmatrix} = \begin{bmatrix} H' \\ B^0 \end{bmatrix} \left. \vphantom{\begin{bmatrix} B \\ S_5 \end{bmatrix}} \right\}$$

Komponente rezultante reakcija

$$\left. \begin{array}{l} \sum M_A = 0 \Rightarrow A^0 \\ \sum M_B = 0 \Rightarrow B^0 \end{array} \right\} \text{ kao reakcije pr. grede}$$

$$\sum X = 0$$

$$H'_A \cdot \cos \alpha_0 - H'_B \cdot \cos \alpha_0 = 0$$

$$H'_A = H'_B = H'$$

$$A = A^0 + Hx (\operatorname{tg} \alpha_0 - \operatorname{tg} \alpha_1)$$

$$B = B^0 + Hx (\operatorname{tg} \alpha_0 - \operatorname{tg} \alpha_n)$$

Poduprti sustav

Ravnoteža dijela nosača-presjekom kroz zglob:

$$yc'' - yc' = f$$

$$\sum X = 0$$

$$H' \cdot \cos \alpha_0 + S_3 \cdot \cos \alpha_3 = 0$$

$$H = H' \cdot \cos \alpha_0; \quad S_3^H = S_3 \cdot \cos \alpha_3$$

$$H = -S_3^H$$

Sile u štapovima ostalim štapovima podupore-iz ravnoteže čvorova:

$$S_i = H / \cos \alpha; \quad V_i = H (\operatorname{tg} \alpha_i - \operatorname{tg} \alpha_{i+1})$$

$$S_{ih} = S_{i+1,h} = S_{i+2,h} = \dots = H$$

Ako su štapovi vješaljke vertikalni.

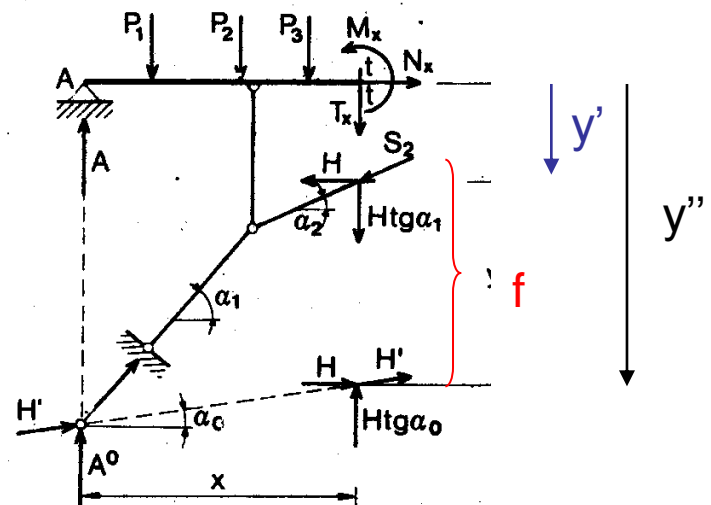
$$\sum M_c = 0$$

$$A^0 \cdot c_a - \sum P_i \cdot c_i - H \cdot y_c'' + H \cdot y_c' = 0$$

$$M_c^0 = A^0 \cdot c_a - \sum P_i \cdot c_i$$

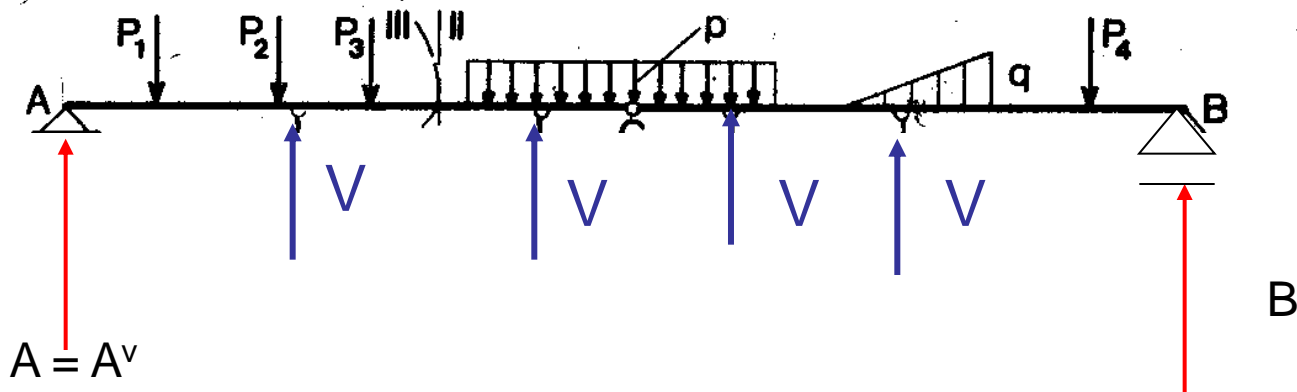
$$M_c^0 - H \cdot (y_c'' - y_c') = 0; \quad M_c^0 - H \cdot f = 0$$

$$H = \frac{M_c^0}{f}$$



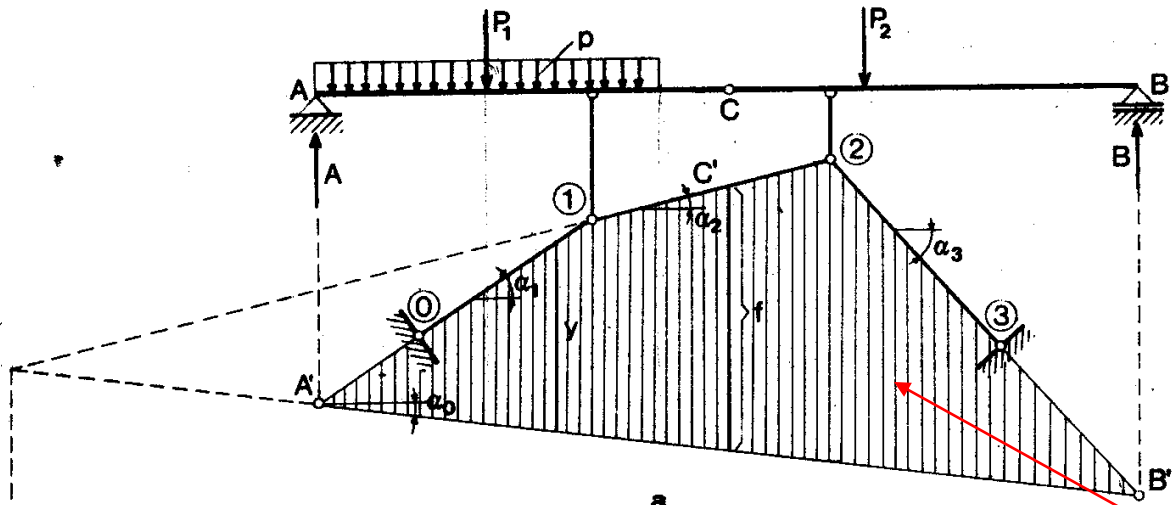
Poduprti sustav

Unutarnje sile na krutom dijelu sustava:

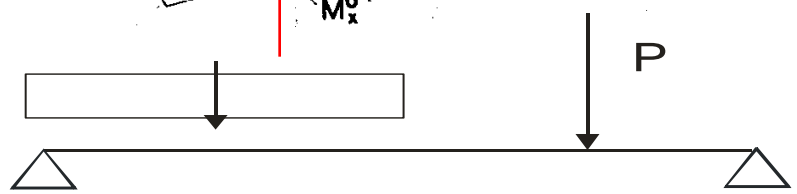
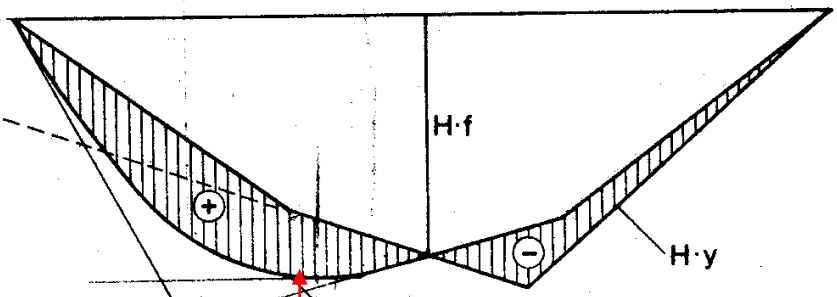


Poduprti sustav

Grafoanalitičko određivanje un. sila



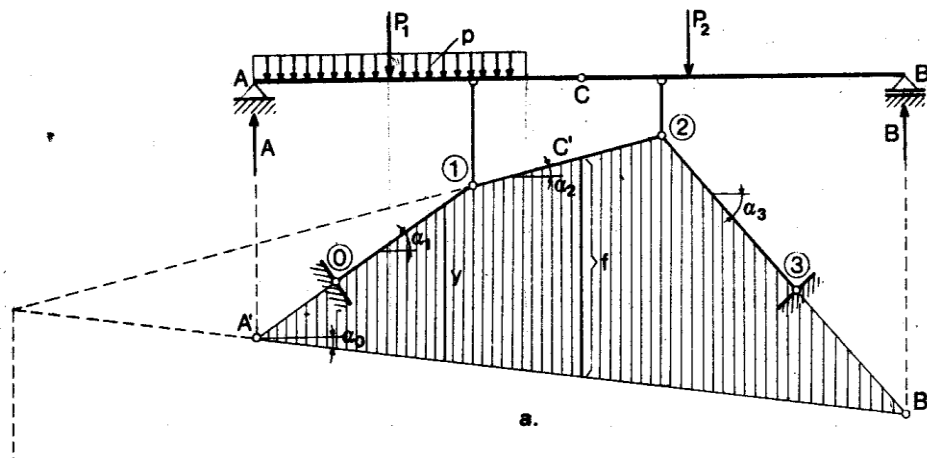
a.
(M)



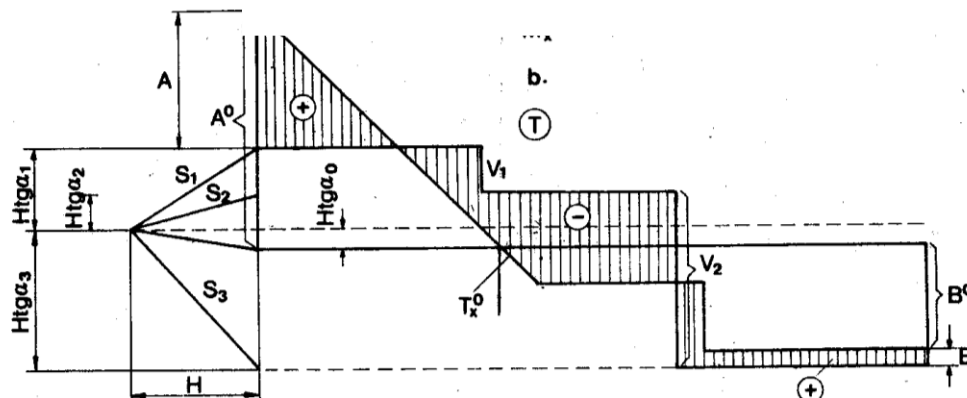
$$M_x = M_x^0 - H \cdot y;$$

Poduprti sustav

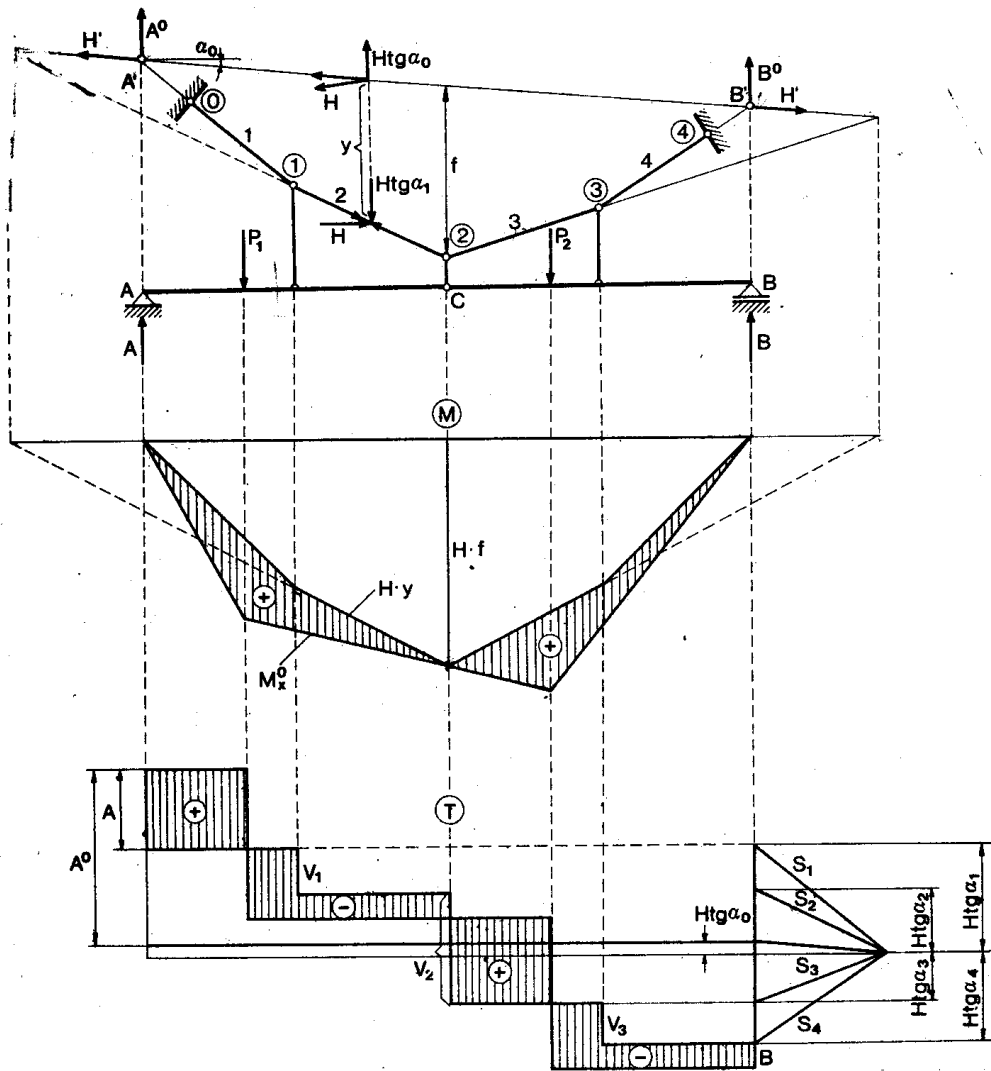
Grafoanalitičko određivanje un. sila



$$T_x = T_x^0 + H^*(\operatorname{tg}\alpha_0 - \operatorname{tg}\alpha_i)$$

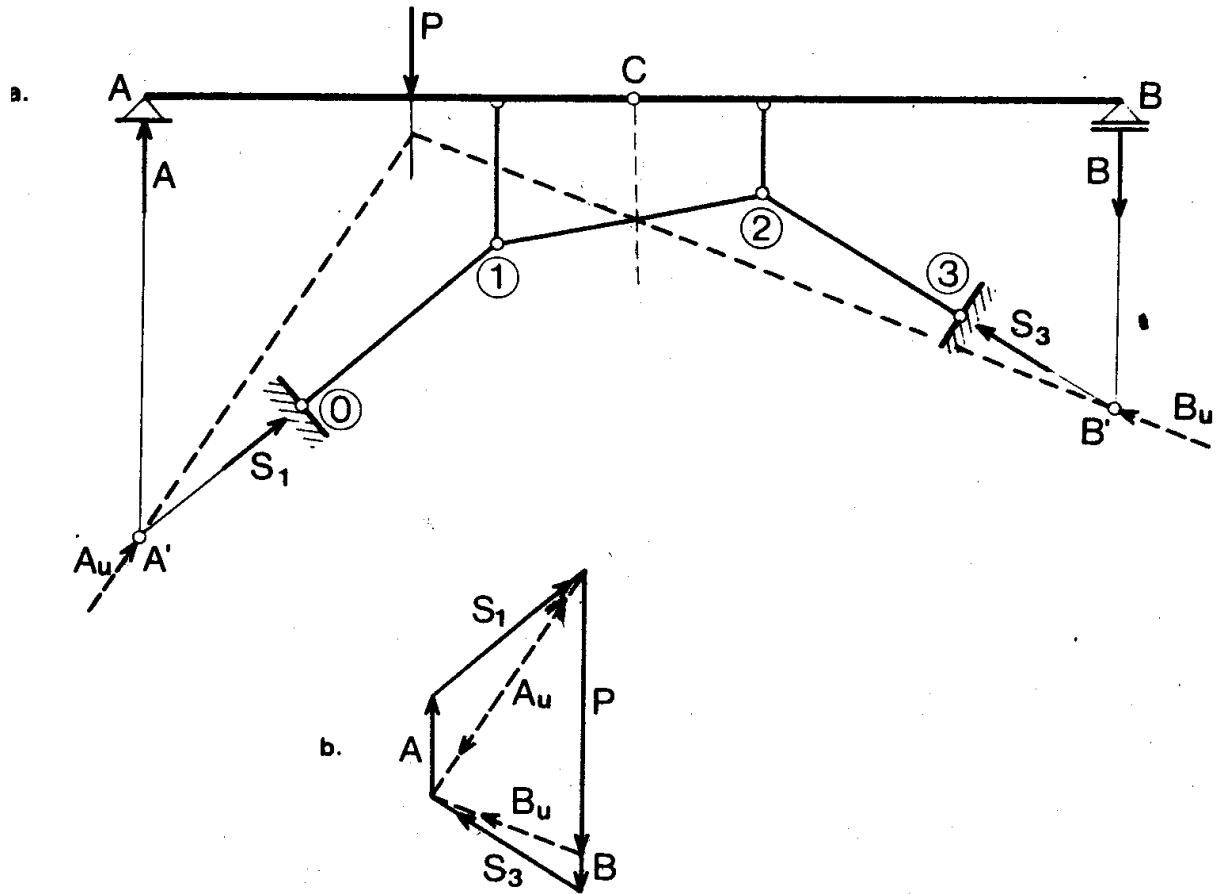


Ovješeni sustavi



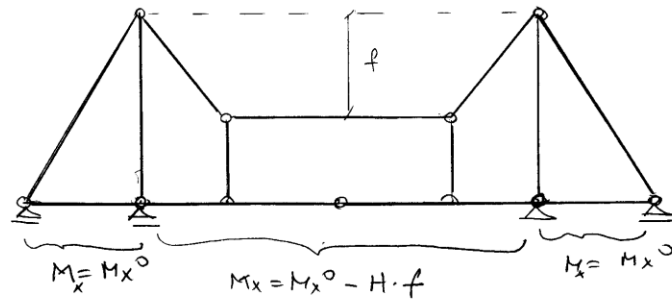
Isti postupak i izrazi kao kod poduprtog sustava.

GRAFIČKO ODREĐIVANJE SILA U ŠTAPU

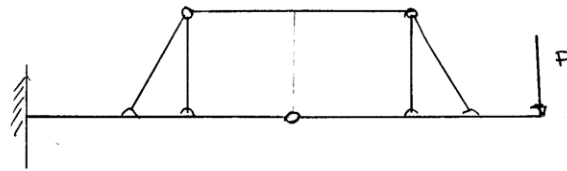


SLOŽENI SUSTAVI

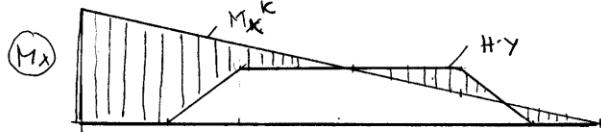
a)



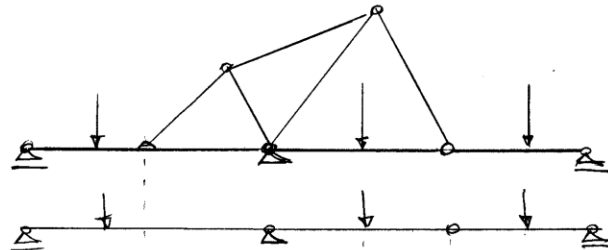
b)



$$M_x = M_x^k - H \cdot y$$



c)



$$M_x = M_x^G - H \cdot y$$

