

A15.

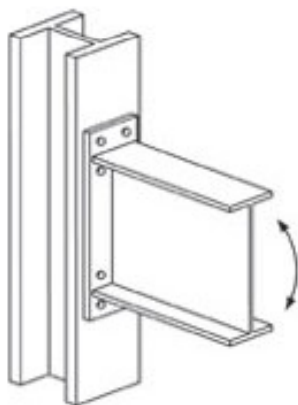
ZAVRTANJSKE VEZE

– Opterečene momentom upravnim na ravan veze

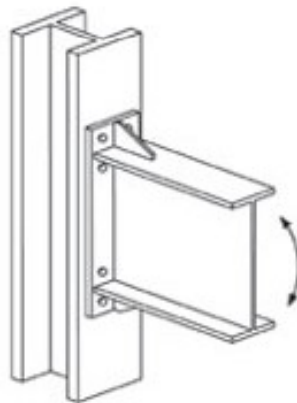
- Veze nosača pod uglom-momentne veze
- Zavrtnajske veze kod čeonih ploča-česte u građevinarstvu

Bez ukrućenja

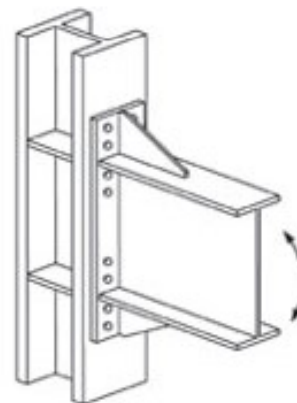
Sa ukrućenjima



(a) Four-Bolt
Unstiffened, 4E

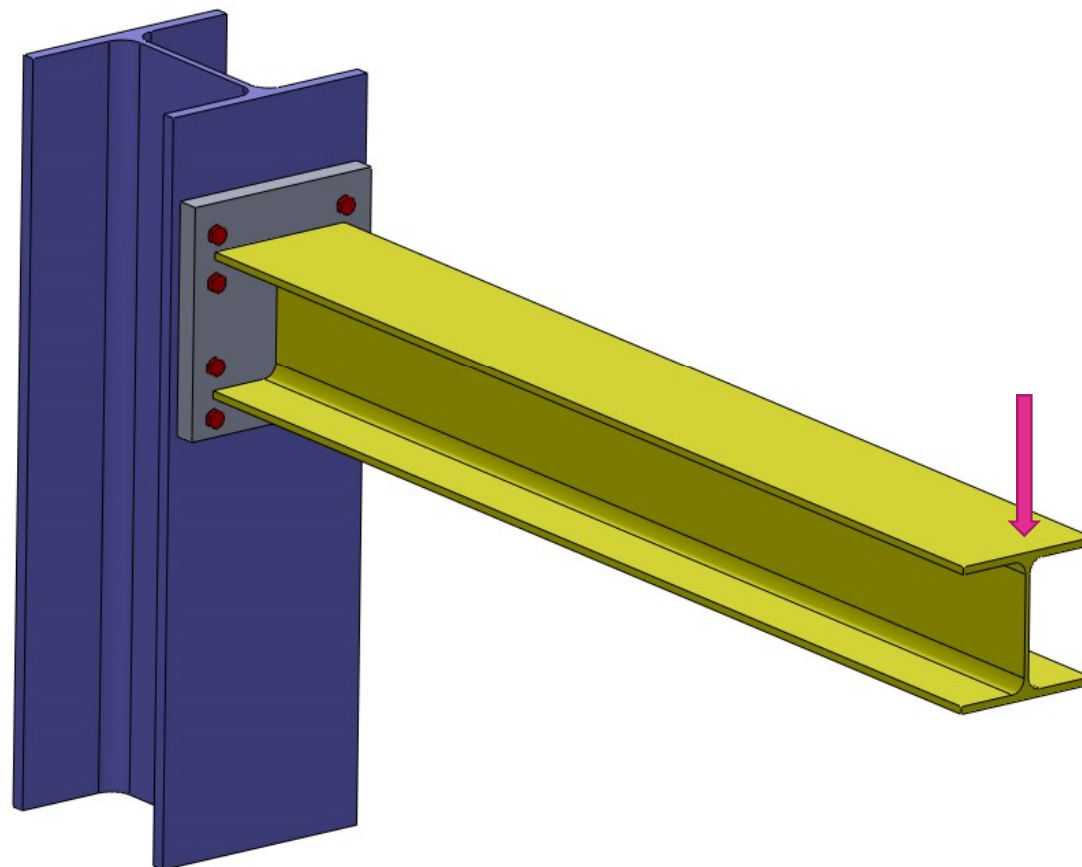


(b) Four-Bolt
Stiffened, 4ES

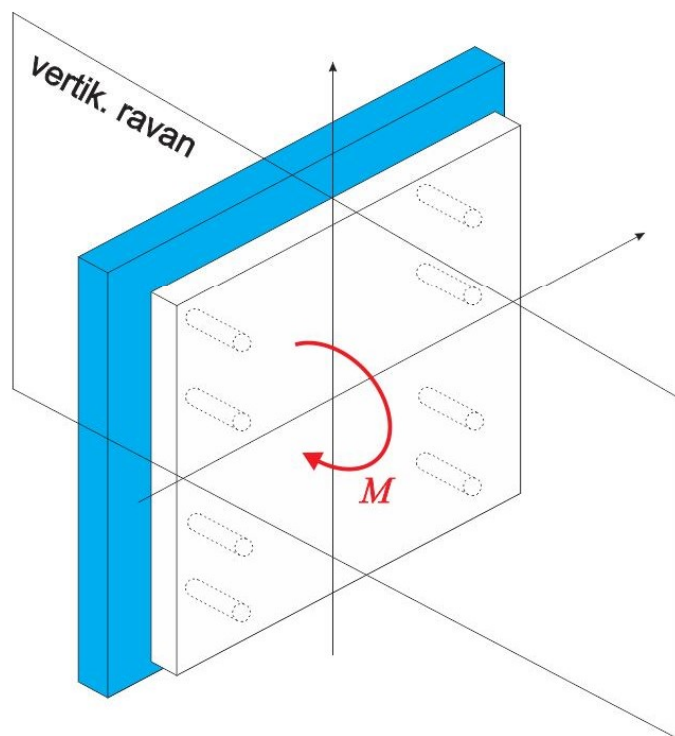


(c) Eight-Bolt
Stiffened, 8ES

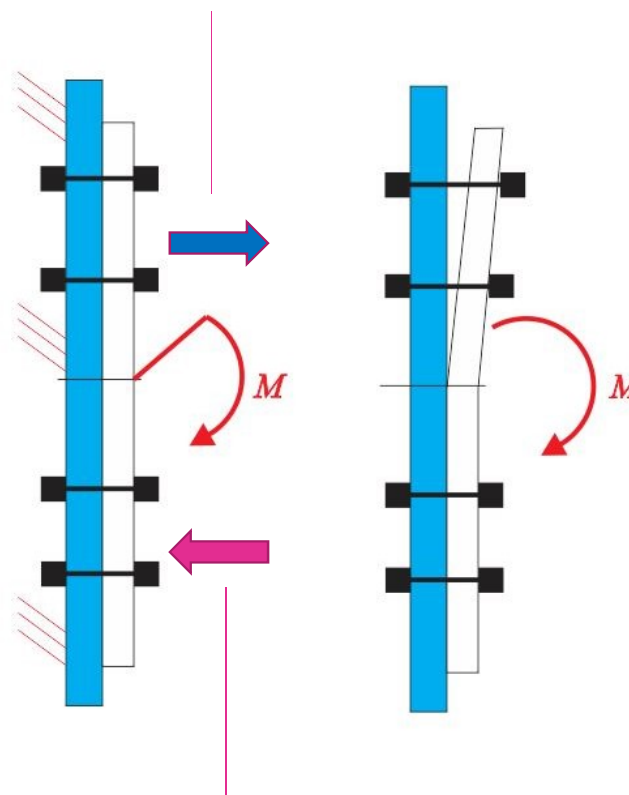
Tipičan primer u mašinstvu – sila na slobodnom kraju konzole



Šta se dešava sa 2 ploče ?

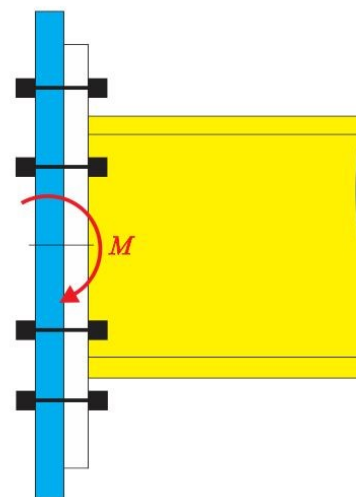
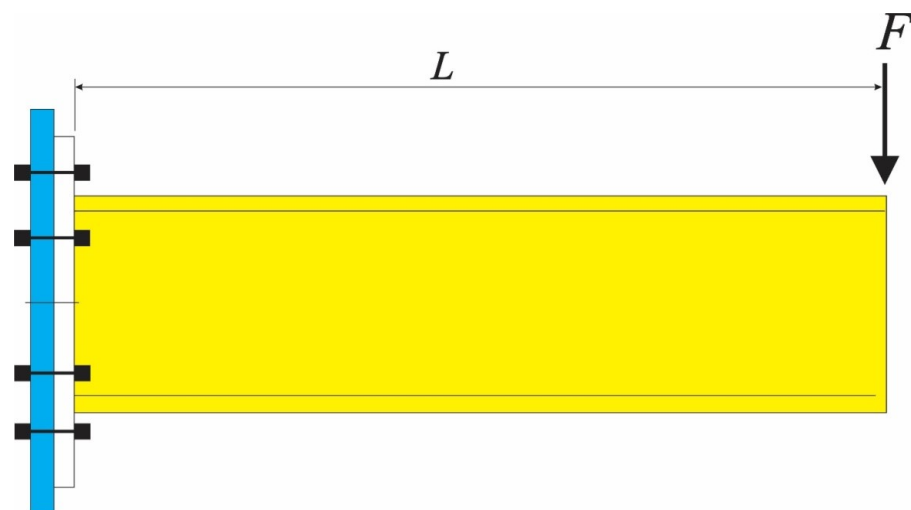
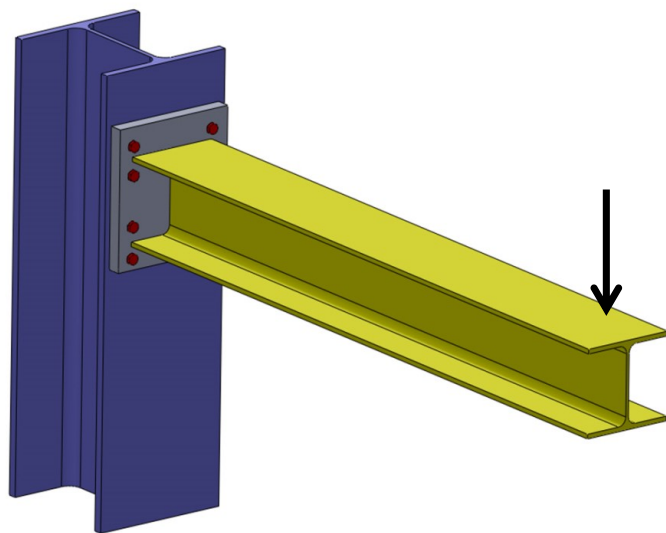


Razdvaja se jedna od druge

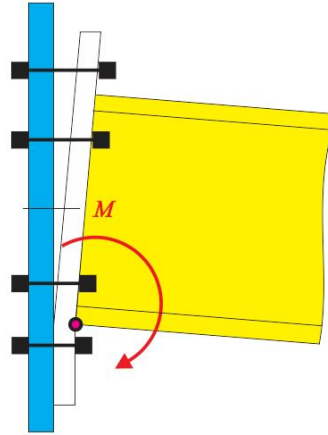
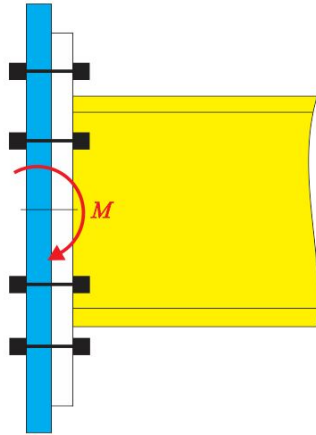


Pritiskaju se jedna uz drugu

Tipičan primer

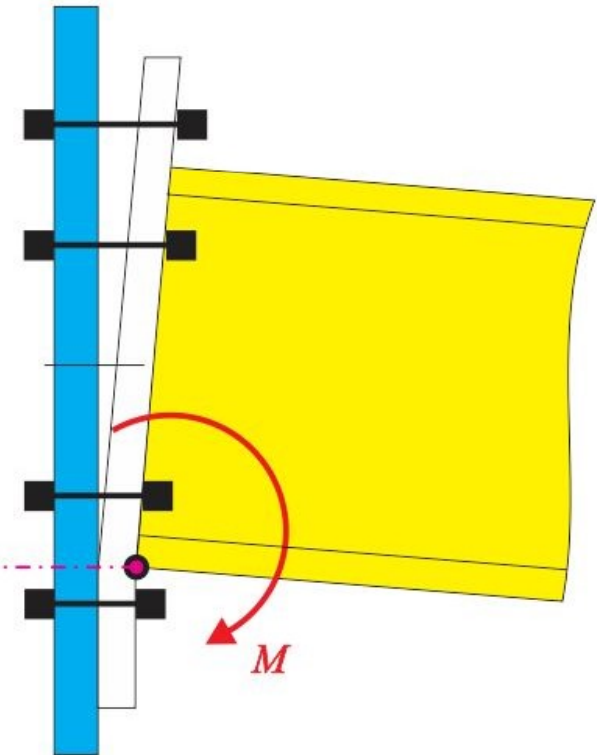


deformisano stanje
(karikirano)



Zbog krutosti nosača koji je zavaren za jednu ploču, sistem se okreće oko krajnje ivice nosača – koja postaje osa “preturanja”

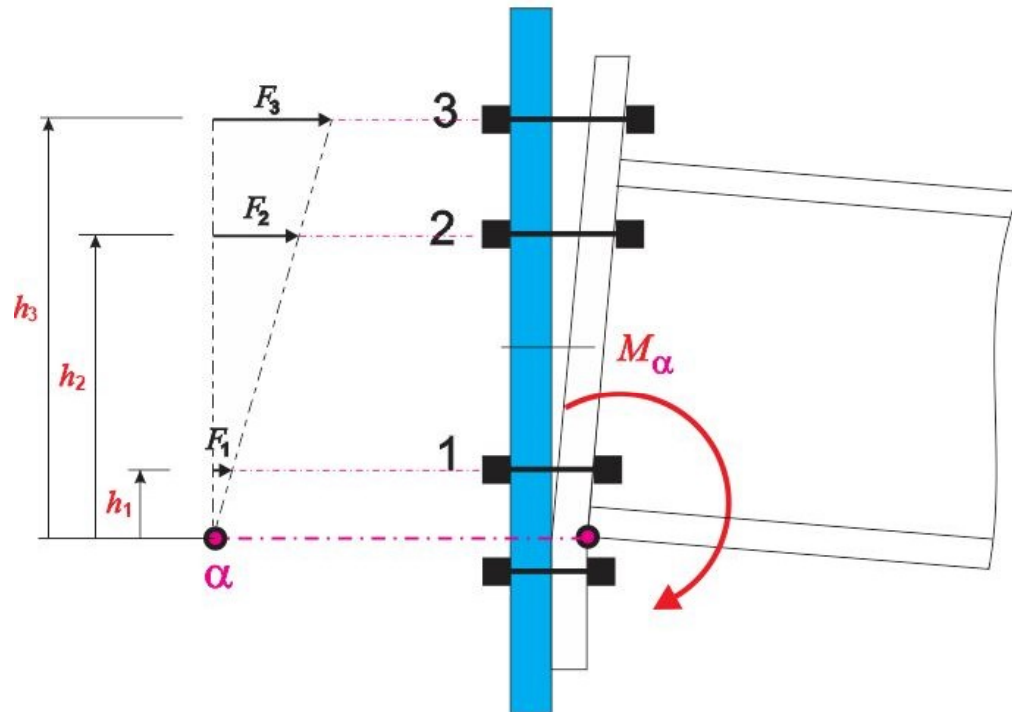
Opterećeni zavrtnjevi
(na zatezanje)



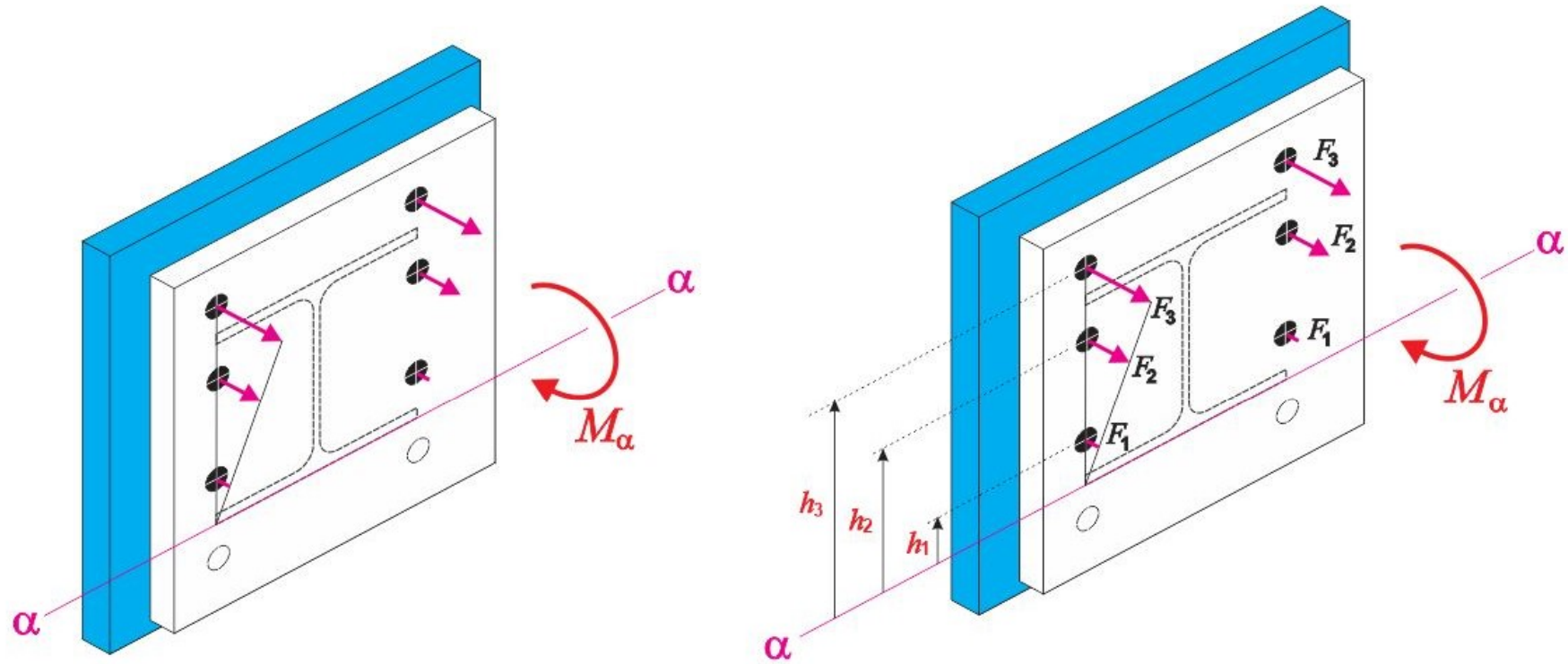
Raspodela zateznih sila u zavrtnjevima

Pretpostavka: Linearna zavisnost između sila i rastojanja

$$\frac{F_1}{h_1} = \frac{F_2}{h_2} = \frac{F_i}{h_i} = \frac{F_{\max}}{h_{\max}}$$



$$M_\alpha = \sum_{i=1}^n F_i \cdot r_i$$



$$M_{\alpha} = \sum_{i=1}^n F_i \cdot r_i$$

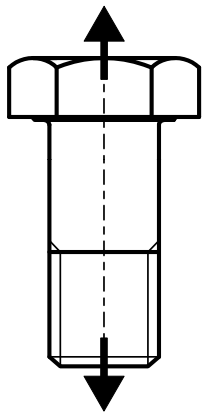
$$M_{\alpha} = 2F_1 \cdot h_1 + 2F_2 \cdot h_2 + 2F_3 \cdot h_3$$

$$\frac{F_1}{h_1} = \frac{F_2}{h_2} = \frac{F_3}{h_3}$$

$$F_1, F_2, F_3$$

Radni naponi kod zavrtnjeva – **zatezno opterećenje**

Zatezanje



Veza opterećena silom

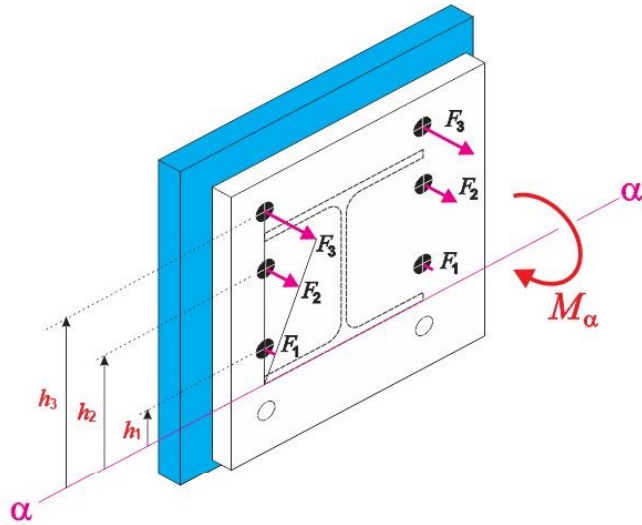
$$\sigma_t = \frac{F_t}{A_s}$$

F_t – sila zatezanja po jednom zavrtnju

A_s – ispitni presek zavrtnja

d	M10	M12	M16	M20	M24	M27	M30
[cm ²]							
A	0,785	1,13	2,01	3,14	4,52	5,73	7,07
A_s	0,58	0,843	1,57	2,45	3,53	4,59	5,61

Veza opterećena momentom $\sigma_t = \frac{M}{I_\alpha} \cdot h$

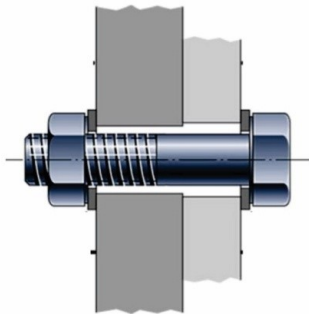


Izraz za određivanje napona u i-tom zavrtnju:

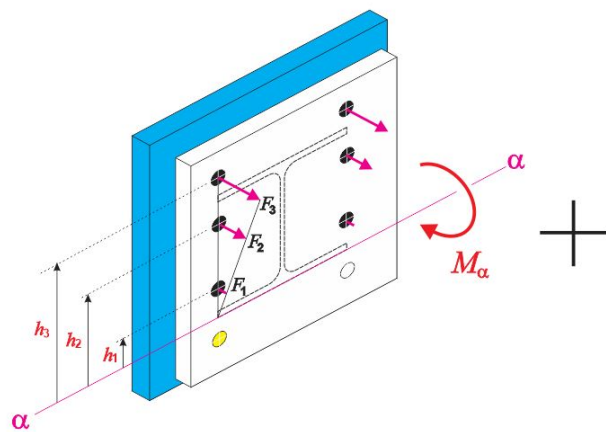
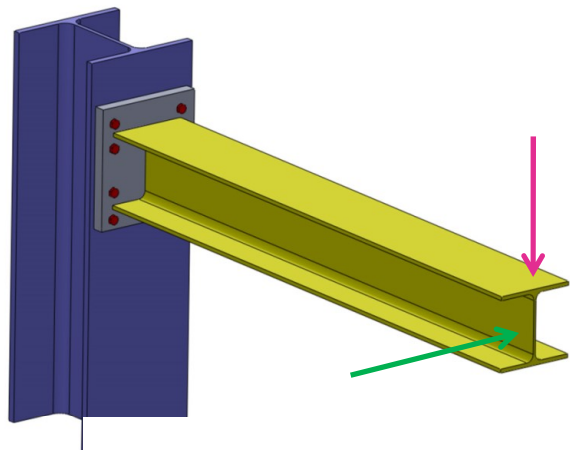
$$\sigma_t = \frac{M_\alpha}{I_\alpha} \cdot h_i$$

h_i - visina i -tog zavrtnja od ose α

I_α - moment inercije površina preseka zavrtnjeva za osu α - α



Kombinacija 2 momenta „preturanja“, tj. u 2 upravne ravni



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