DESAIN TEKAN PROFIL SIKU SAMA KAKI YANG ELEMENNYA TIDAK LANGSING

Satuan : $kN := 1000N$ $MPa := 1\frac{N}{mm^2}$

Panjang Efektif $kLx := 1m$ $kLy := 2m$ $kLz := 2m$

Data Penampang Profil L50.50.5

$A := 4.802cm^2$ $b := 50mm$ $t := 5mm$

$imin := 0.98cm$ $imaks := 1.91cm$ Jarak titik berat $e := 1.41cm$

Data Bahan $E := 2\cdot10^5MPa$ $G := \frac{E}{2.6}$ $Fy := 250MPa$ (Bj. 41)

Beban Terfaktor $Pu := 50kN$

Cek kelangsingan penampang

$\frac{b}{t} = 10$ $0.45\sqrt{\frac{E}{Fy}} = 12.73$

$Cek := \begin{cases} \text{"Penampang Tidak Langsing"} & \text{if } \frac{b}{t} \le 0.45\sqrt{\frac{E}{Fy}} \\ \text{"Penampang LANGSING"} & \text{otherwise} \end{cases}$

Cek = "Penampang Tidak Langsing"

Menghitung kuat tekuk lentur untuk sumbu η (sumbu lemah)

$rx := imin$ $rx = 0.98\cdot cm$

$\frac{kLx}{rx} = 102.041$

$Cek := \begin{cases} \text{"OK"} & \text{if } \frac{kLx}{rx} \le 200 \\ \text{"Tidak OK!"} & \text{otherwise} \end{cases}$

Cek = "OK"

$\lambda c := \frac{kLx}{rx\cdot\pi}\cdot\sqrt{\frac{Fy}{E}}$ $\lambda c = 1.15$

$Fcr1 := \begin{cases} \left(0.658^{\lambda c^2}\right)\cdot Fy & \text{if } \lambda c \le 1.5 \\ \left(\frac{0.877}{\lambda c^2}\cdot Fy\right) & \text{if } \lambda c > 1.5 \end{cases}$ $Fcr1 = 143.96\cdot MPa$

Menghitung Kuat Tekuk Torsi Lentur untuk Sumbu ζ

Prosedur yang digunakan adalah AISC Appendix E3, bukan AISC Section E3, karena AISC Section E3 hanya untuk profil siku ganda atau profil T.

$Iy := imaks^2\cdot A$ $Iy = 17.52\cdot cm^4$

$Ix := imin^2\cdot A$ $Ix = 4.61\cdot cm^4$

Hati - hati, η dan ζ ini adalah sumbu miring 45 derajat, bukan sumbu sejajar kaki

$J := \frac{2}{3}\left(b - \frac{t}{2}\right)\cdot t^3$ $\quad J = 0.4\cdot cm^4$

$Cw := \frac{2}{36}\left[(b - 0.5t)^3\cdot t^3\right]$ $\quad Cw = 0.744\cdot cm^6$

$x0 := 0mm$ $\quad y0 := \frac{(e - 0.5\cdot t)}{\cos(45deg)}$ $\quad y0 = 1.64\cdot cm$

$r0 := \sqrt{x0^2 + y0^2 + \frac{(Ix + Iy)}{A}}$ $\quad r0^2 = 7.3\cdot cm^2$ $\quad y0^2 = 2.691\cdot cm^2$

(notasi AISC pakai tanda bar dan indeks nol)

$H := 1 - \left(\frac{x0^2 + y0^2}{r0^2}\right)$ $\quad H = 0.63$

$ry := \sqrt{\frac{Iy}{A}}$ $\quad ry = 1.91\cdot cm$

$\lambda y := \frac{kLy}{ry}$ $\quad \lambda y = 104.71$

$Fey := \frac{\pi^2 E}{\lambda y^2}$ $\quad Fey = 180.03\cdot MPa$

$Fez := \left[\frac{\pi^2 E\, Cw}{(kLz)^2} + G\cdot J\right]\cdot\frac{1}{A\cdot r0^2}$ $\quad Fez = 869.69\cdot MPa$

$Fe := \frac{Fey + Fez}{2\cdot H}\left[1 - \sqrt{1 - \frac{4\cdot Fey\cdot Fez\cdot H}{(Fey + Fez)^2}}\right]$ $\quad Fe = 165.66\cdot MPa$

$\lambda e := \sqrt{\frac{Fy}{Fe}}$ $\quad \lambda e = 1.23$

$$Fcr2 := \begin{cases} \left(0.658^{\lambda e^2}\right)\cdot Fy & \text{if } \lambda e \le 1.5 \\ \left(\frac{0.877}{\lambda e^2}\cdot Fy\right) & \text{if } \lambda e > 1.5 \end{cases}$$

$Fcr2 = 132.93\cdot MPa$

Kuat Desain Batang Tekan ini

$\phi c := 0.85$ $\quad Fcr := \min(Fcr1, Fcr2)$ $\quad Fcr = 132.93\cdot MPa$

$\phi c\cdot Fcr\cdot A = 54.26\cdot kN$

$$Cek := \begin{cases} \text{"OK"} & \text{if } \phi c\cdot Fcr\cdot A > Pu \\ \text{"Tidak OK"} & \text{otherwise} \end{cases}$$

$Cek = \text{"OK"}$