Shrinkage Strain following CEB-FIP 1990

$f_{ck} := 35 \cdot MPa$ specified strength

$RH := 70$ Relative humidity, enter in percent, i,e, 0 to 100 and without % symbol (permitted 40 and above)

$T_{mean\_while\_shrinking} := 17 \cdot °C$ in whole shrinkage period

$A_c := 900 \cdot cm^2$ section of the structural member

$u := 1.2m$ exposed perimeter

$t_s := 1 \cdot day$ age at which shrinkage starts

$\beta_{sc} := 8$

8 for rapid hardening high strength cement
5 normal or rapid hardening cement
4 slow hardening cement

$f_{cm} := f_{ck} + 8 \cdot MPa$ accepted mean value at 28 days age

valid up to fcm=90 MPa

$E_{c0} := 21500\,MPa$ $f_{cm0} := 10 \cdot MPa$ $RH_0 := 100$ $h_0 := 100 \cdot mm$ $t_1 := 1 \cdot day$ reference values

$$\beta_{sRH} := 1 - \left(\frac{RH}{RH_0}\right)^3$$

$$\beta_{RH} := \begin{cases} -1.55 \cdot \beta_{sRH} & \text{if } 1 = \text{AND2}(40 \le RH, RH \le 99) \\ 0.25 & \text{otherwise} \end{cases}$$

$$\beta_{RH\_corr} := \beta_{RH} \cdot \left[1 + \left(\frac{8}{103 - 100 \cdot \frac{RH}{RH_0}}\right) \cdot \left(\frac{\frac{T_{mean\_while\_shrinking}}{day} - 20}{40}\right)\right]$$

$$\epsilon_{s\_fcm} := \left[160 + 10 \cdot \beta_{sc} \cdot \left(9 - \frac{f_{cm}}{f_{cm0}}\right)\right] \cdot 10^{-6}$$

$$\epsilon_{cs0\_corr} := \epsilon_{s\_fcm} \cdot \beta_{RH\_corr}$$

$h := 2 \cdot \frac{A_c}{u}$ $h = 150mm$ mean thickess for calculus

$$\beta_{SH} := 350 \cdot \left(\frac{h}{h_0} \right)^2$$

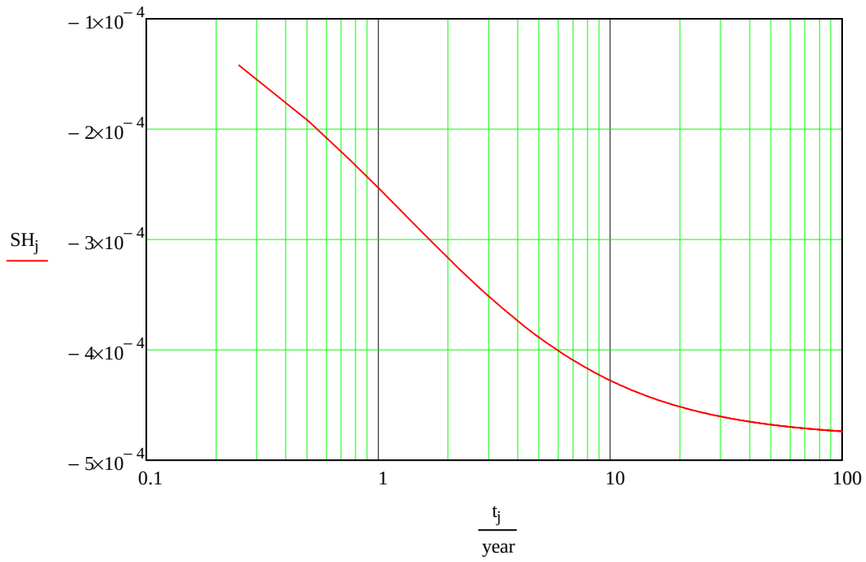
$$\beta_{SH\_corr} := \beta_{SH} \cdot e^{-0.06 \cdot \left(\frac{T_{mean\_while\_shrinking}}{°C} - 20 \right)}$$

$$\beta_{s\_corr}(t) := \sqrt{\frac{\frac{t - t_s}{day}}{\beta_{SH\_corr} + \frac{t - t_s}{day}}}$$

$$\epsilon_{cs}(t) := \epsilon_{cs0\_corr} \cdot \beta_{s\_corr}(t)$$

$T_{end} := 100 \cdot year$

$Parts := 400$ $\quad j := 1 .. Parts + 1$ $\quad t_j := \frac{T_{end}}{Parts} \cdot (j - 1)$ $\quad SH_j := \epsilon_{cs}(t_j)$



- Note that the strains are represented negative anl lower are bigger

$T := 50 \cdot year$ time at which the shrinkage strain is required $\epsilon_{cs}(T) = -0.000468$ the required unrestrained shrinkage strain to age