۸۷/۲/۱۷ بابسه نعالی

تحلیل نیروی سازه ها ← خرپا

کابل ← قاب و سه بند

کابل ← بارمتمرکز

بارگسترده ← $W(x)$

$W(S)$ (وزن)

بارگسترده $W(x)$ (تابعی از طول افقی کابل)

$T\cos\theta = F_H$

$T\sin\theta = \int_{W(S)\,ds}^{W(x)\,dx}$

$T = \sqrt{F_H^2 + \left(\int W(x)\,dx\right)^2}$

$\tan\theta = \frac{dy}{dx} = \frac{1}{F_H}\int W(x)\,dx$

$\frac{d^2y}{dx^2} = \frac{W(x)}{F_H}$

$W(S)\,ds$ (۲)

$L = \int ds = \int \sqrt{1+\left(\frac{dy}{dx}\right)^2}\,dx$

بارگسترده $W(S)$ (تابعی از طول قوسی کابل)

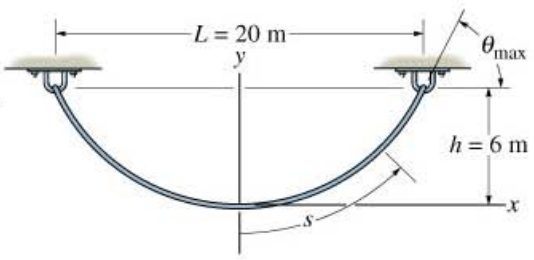
$(ds)^2 = (dx)^2 + (dy)^2$

$\frac{dy}{dx} = \sqrt{\left(\frac{ds}{dx}\right)^2 - 1}$ (۱)

$\frac{1}{F_H}\int W(s)\,ds = \sqrt{\left(\frac{ds}{dx}\right)^2 - 1} \rightarrow \frac{ds}{dx} = \left[1+\left(\frac{1}{F_H}\int W(s)\,ds\right)^2\right]^{+\frac{1}{2}}$

$x = \int \frac{ds}{\left[1+\left(\frac{1}{F_H}\int W(s)\,ds\right)^2\right]^{\frac{1}{2}}}$

مثال: منحنی تغییر شکل، طول، حداکثر کشش



$w_0 = 5 \frac{N}{m}$

$$\int w(s)\,ds = \int w_0\,ds = w_0 s + C_1$$

$$x = \int \frac{ds}{\left[1 + \left(\frac{w_0 s + C_1}{F_H}\right)^2\right]^{\frac{1}{2}}} =$$

$$u = \frac{w_0 s + C_1}{F_H}$$

$$du = \frac{w_0}{F_H} ds$$

$$x = \frac{F_H}{w_0} \int \frac{du}{\sqrt{1+u^2}} = \frac{F_H}{w_0} \left(\sinh^{-1} u + C_2\right)$$

$$\begin{cases} s=0,\ \frac{dy}{dx} = 0 \\ s=0,\ x=0 \end{cases}$$

$$\frac{dy}{dx} = \frac{1}{F_H}(w_0 s + C_1) \longrightarrow C_1 = 0 \quad (1)$$

$$x = \frac{F_H}{w_0} \left(\sinh^{-1}\left(\frac{w_0 s}{F_H}\right) + C_2\right) \longrightarrow C_2 = 0$$

$$x = \frac{F_H}{w_0} \left(\sinh^{-1} \frac{w_0 s}{F_H}\right) \longrightarrow s = \frac{F_H}{w_0} \sinh \frac{w_0 x}{F_H}$$

(1)

$$\frac{dy}{dx} = \frac{w_0 s}{F_H} = \sinh \frac{w_0 x}{F_H}$$

$$y = \frac{F_H}{w_0} \cosh \frac{w_0 x}{F_H} + C_3$$

$x = 0,\ y = 0$

$$y = \frac{F_H}{w_o}\left(\cosh\frac{w_o x}{F_H} - 1\right)$$

$$\begin{cases} x = \frac{L}{2} \\ y = h \end{cases} \qquad h = \frac{F_H}{w_o}\left(\cosh\frac{w_o L}{2F_H} - 1\right)$$

$$6 = \frac{F_H}{5}\left(\cosh\frac{50}{F_H} - 1\right) \longrightarrow F_H =$$

$$Z = \frac{F_H}{5}\left(\cosh\frac{50}{F_H} - 1\right) - 6 = 0$$

$F_H = 11 \quad Z = 95$

$F_H = 120 \quad Z = -3.9$

$F_H = 50 \quad Z = -.5$

$F_H = 45.9\ N$

$$y = \frac{45.9}{5}\left(\cosh\frac{5}{45.9}x - 1\right) = 9.19\left(\cosh .109x - 1\right)$$

$$S = 9.19 \sinh .109x$$

$$\frac{L}{2} = 9.19 \sinh(.109 \times 10) \qquad L = 24.2\ m$$