Tapered Lifting Line Model

$N := 500 \qquad \theta(m) := \pi \cdot \frac{m}{N+1} \qquad b := 7 \qquad Cla := 2 \cdot \pi$

$$cc := \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \qquad yy := \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \cdot \frac{b}{2} \qquad tt := \begin{bmatrix} 5 \\ 5 \\ 0 \\ 0 \\ -5 \\ -5 \end{bmatrix} \cdot \frac{\pi}{180} = \begin{bmatrix} 0.087 \\ 0.087 \\ 0 \\ 0 \\ -0.087 \\ -0.087 \end{bmatrix} \quad yt := \begin{bmatrix} -1 \\ -0.9 \\ -0.5 \\ 0.5 \\ 0.9 \\ 1 \end{bmatrix} \cdot \frac{b}{2}$$

$cy(y) := \text{linterp}(yy, cc, y)$

$aaeroy(y) := \text{linterp}(yt, tt, y)$

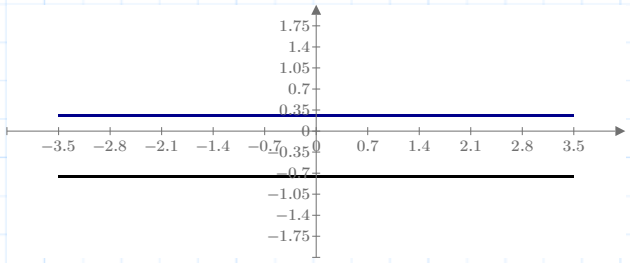
$c(\theta) := cy\left(\frac{b}{2} \cdot \cos(\theta)\right)$

$aaero(\theta) := aaeroy\left(\frac{b}{2} \cdot \cos(\theta)\right)$

$cy\_fore(y) := \frac{cy(y)}{4} \qquad cy\_aft(y) := -cy(y) \cdot \frac{3}{4}$

$S := \int_{\frac{-b}{2}}^{\frac{b}{2}} cy(y)\, dy \quad S = 7$

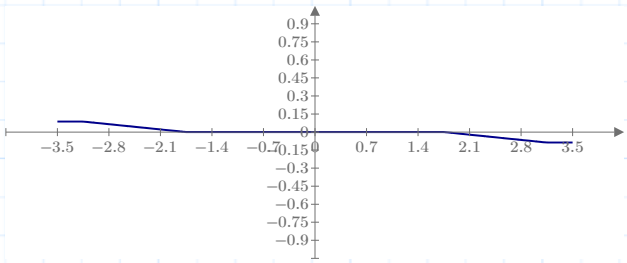
$AR := \frac{b^2}{S} = 7$



$cy\_fore(y)$

$cy\_aft(y)$

y



$aaeroy(y)$

y

$$a(m,n) := \sin(n \cdot \theta(m)) + \frac{c(\theta(m))}{4 \cdot b} \cdot Cla \cdot n \cdot \frac{\sin(n \cdot \theta(m))}{\sin(\theta(m))} \qquad aoa := \frac{5}{57.3}$$

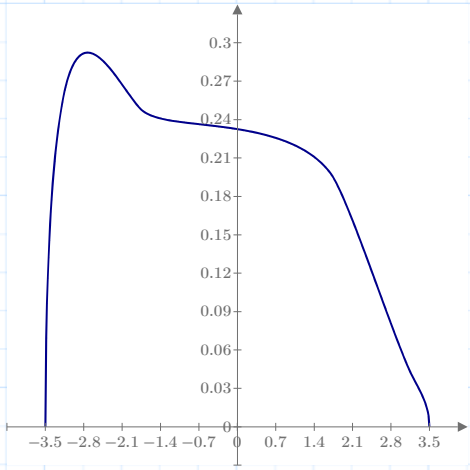
$$r(m) := \frac{c(\theta(m))}{4 \cdot b} \cdot Cla \cdot (aoa + aaero(\theta(m)))$$

$$i := 1..N \qquad j := 1..N$$

$$aa_{i,j} := a(i,j) \qquad rr_j := r(j) \qquad A := aa^{-1} \cdot rr$$

$$\Gamma a(x) := 2 \cdot b \cdot \sum_{k=1}^{N} A_k \cdot \sin\left(k \cdot \operatorname{acos}\left(2 \cdot \frac{x}{b}\right)\right)$$

$$A = \begin{bmatrix} 0.019 \\ -0.006 \\ 0.002 \\ -0.003 \\ 5.612 \cdot 10^{-4} \\ -6.027 \cdot 10^{-5} \\ 1.679 \cdot 10^{-4} \\ 2.286 \cdot 10^{-4} \\ 6.257 \cdot 10^{-5} \\ -1.296 \cdot 10^{-4} \\ 2.769 \cdot 10^{-5} \\ 6.543 \cdot 10^{-6} \\ \vdots \end{bmatrix}$$



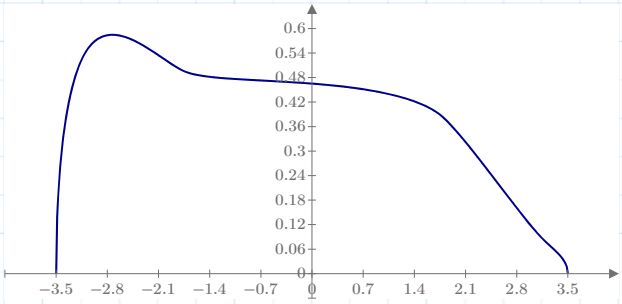
$\Gamma a(x)$

x

$$CL := \pi \cdot \frac{b^2}{S} \cdot A_1 \qquad CL = 0.41$$

$$CD := \pi \cdot AR \cdot \sum_{k=1}^{N} A_k^{\,2} \qquad CD = 0.009$$

Sectional Lift Coefficient



y

$$2 \cdot \frac{\Gamma a(y)}{cy(y)}$$