$T := 4119\,lbf \cdot ft$

$d_o := 0.906\,in$ $d_i := 0.677\,in$ $D := 0.807\,in$ $L_e := 0.080\,in$

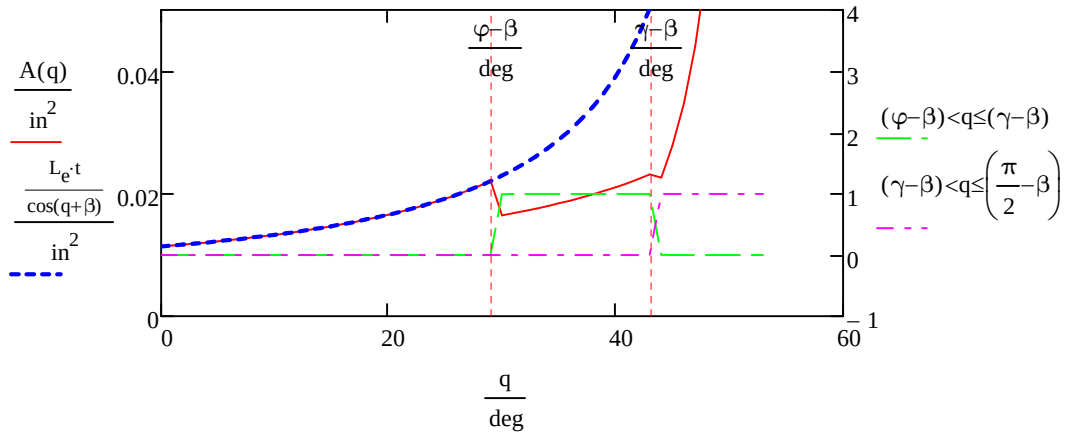
$h := 0.118\,in$ $\alpha := 17.105\,deg$ $\beta := 36.5\,deg$ $\varphi := \operatorname{atan}\left(\frac{h}{L_e} + \tan(\beta)\right)$

$\gamma := \operatorname{atan}\left(\frac{h}{L_e} + \tan(\beta) + \frac{1}{\tan(\alpha)}\right)$

$t := \frac{d_o - d_i}{2}$ $t = 0.114\,in$

$$A(\theta) := t \cdot \left[\frac{L_e}{\cos(\theta + \beta)} - \left[\begin{pmatrix} L_e \cdot \tan(\theta + \beta) \ \ldots \\ + -h + L_e \cdot \tan(\beta) \end{pmatrix} \cdot [(\varphi - \beta) < \theta \le (\gamma - \beta)] \ \ldots \right. \right.$$
$$\left. \left. + \left[h + L_e \cdot \left(\tan(\beta) + \frac{1}{\tan(\alpha)} \right) \right] \cdot \left[(\gamma - \beta) < \theta \le \left(\frac{\pi}{2} - \beta \right) \right] \right] \cdot \frac{\sin(\alpha)}{\sin\left(\frac{\pi}{2} + \theta + \beta - c \right.}$$

$q := 0, 1\,deg .. \frac{\pi}{2} - \beta$

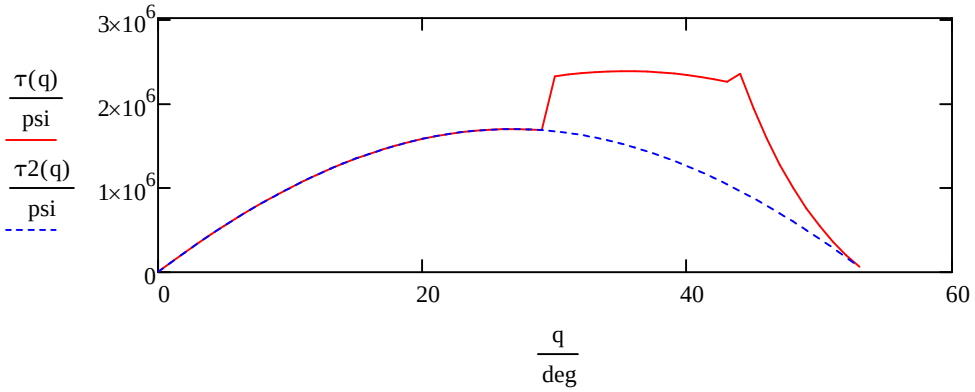


$F_n := \frac{T}{D \cdot \cos(\beta)}$

$\tau(\theta) := \frac{F_n \cdot \sin(\theta)}{A(\theta)}$

Simplified stress:

$$\tau 2(\theta) := \frac{F_n \cdot \sin(\theta)}{\frac{L_e \cdot t}{\cos(\theta+\beta)}}$$



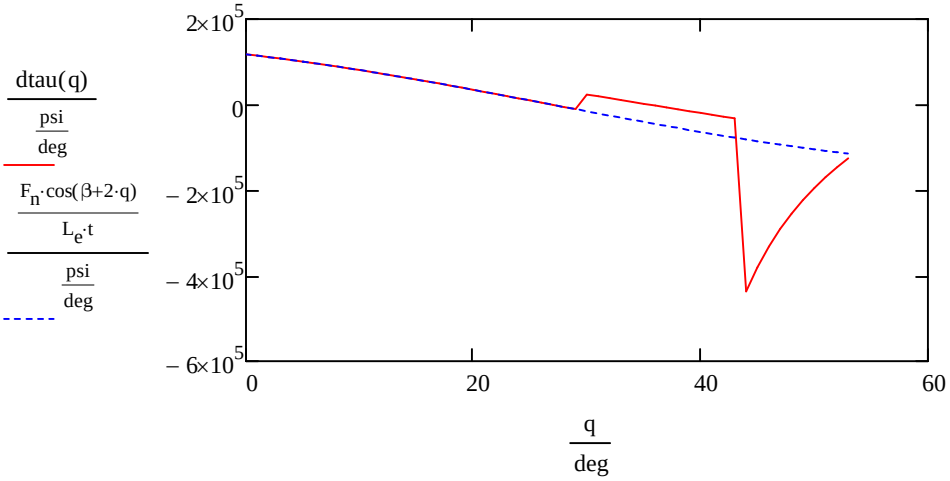
Symbolic derivative of simplified stress function:

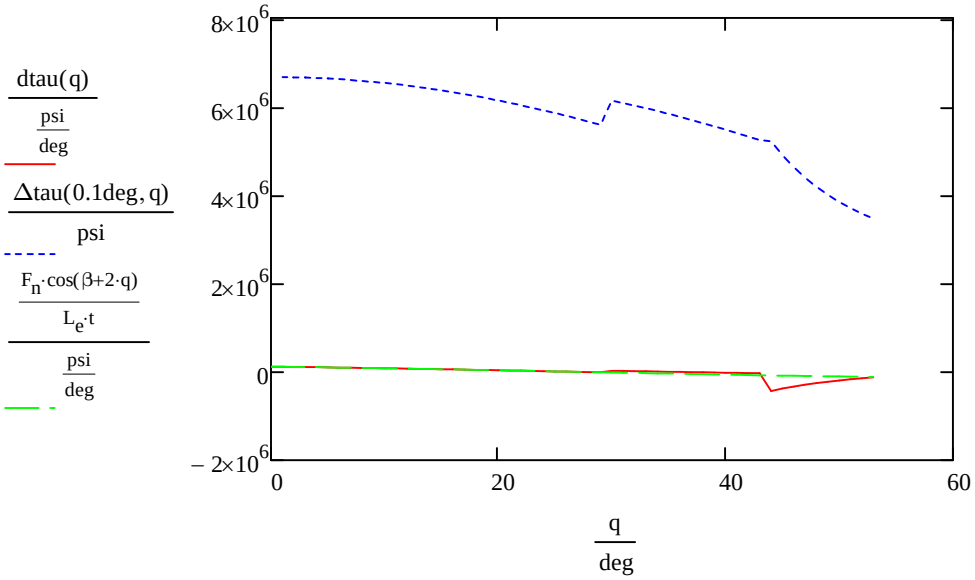
$$\tau(\theta) := \frac{F_n \cdot \sin(\theta)}{\frac{L_e \cdot t}{\cos(\theta+\beta)}}$$

mathcad derivative finite difference derivative

$$dtau(\theta) := \frac{d}{d\theta}\tau(\theta) \qquad \Delta tau(x,\theta) := \frac{\tau(x+\theta) - \tau(x-\theta)}{2\cdot\theta}$$

$$\frac{d}{d\theta}\tau(\theta) \text{ simplify } \rightarrow \frac{F_n \cdot \cos(\beta + 2\cdot\theta)}{L_e \cdot t}$$




dtau(q)
psi
deg
Δtau(0.1deg, q)
psi
F_n·cos(β+2·q)
L_e·t
psi
deg
8×10^6
6×10^6
4×10^6
2×10^6
0
– 2×10^6
0
20
40
60
q
deg