

Timoshenko formula for u_theta evaluated for: r=a and theta=0, 30, 60, 90 degrees

$$u0 := -.01$$

$$E := 10000.$$

$$a := 5.$$

$$b := 10.$$

$$\mu := .25$$

$$r := a$$

$$k := \left(\frac{1}{2}\right)(1 - 3\mu)a^2 - b^2 \left[\frac{(1 + \mu)}{2}\right] - (a^2 + b^2) \cdot (1 - \mu) \cdot \log(a)$$

$$k = -124.903437907$$

$$n := a^2 - b^2 + (a^2 + b^2) \log\left(\frac{b}{a}\right)$$

$$n = -37.371250542$$

$$p := \frac{-(u0 \cdot E \cdot n)}{\pi(a^2 + b^2)}$$

$$p = -9.516510805$$

theta = 0 degree

$$th := 0$$

$$c := \cos(th)$$

$$s := \sin(th)$$

$$c = 1$$

$$s = 0$$

$$ut := \left[\left[\left(\frac{1}{2} \right) \cdot (5 + \mu) \cdot r^2 - a^2 \cdot b^2 \cdot \frac{(1 + \mu)}{2 \cdot r^2} \right] + (a^2 + b^2) \cdot [(1 - \mu) \cdot \log(r) - (1 + \mu)] \right] \cdot c - (a^2 + b^2) \cdot (th - \pi) \cdot s - k \cdot c$$

$$ut := ut \cdot \frac{p}{(n \cdot E)}$$

$$ut = 0.000950012$$

theta = 30 degree

$$th := \left(\frac{1}{3}\right) \frac{\pi}{2}$$

$$c := \cos(th)$$

$$s := \sin(th)$$

$$c = 0.866025404$$

$$s = 0.5$$

$$ut := \left[\left[\left(\frac{1}{2} \right) \cdot (5 + \mu) \cdot r^2 - a^2 \cdot b^2 \cdot \frac{(1 + \mu)}{2 \cdot r^2} \right] + (a^2 + b^2) \cdot [(1 - \mu) \cdot \log(r) - (1 + \mu)] \right] \cdot c - (a^2 + b^2) \cdot (th - \pi) \cdot s - k \cdot c$$

$$ut := ut \cdot \frac{p}{(n \cdot E)}$$

$$ut = 0.004989401$$

theta = 60 degree

$$th := \left(\frac{2}{3}\right) \frac{\pi}{2}$$

$$c := \cos(th)$$

$$s := \sin(\text{th})$$

$$c = 0.5$$

$$s = 0.866025404$$

$$\text{ut} := \left[\left[\left(\frac{1}{2} \right) \cdot (5 + \text{mu}) \cdot r^2 - a^2 \cdot b^2 \cdot \frac{(1 + \text{mu})}{2 \cdot r^2} \right] + (a^2 + b^2) \cdot [(1 - \text{mu}) \cdot \log(r) - (1 + \text{mu})] \right] \cdot c - (a^2 + b^2) \cdot (\text{th} - \pi) \cdot s - k \cdot c$$

$$\text{ut} := \text{ut} \cdot \frac{p}{(n \cdot E)}$$

$$\text{ut} = 0.006248509$$

$$\text{theta} = 90 \text{ degree}$$

$$\text{th} := \frac{\pi}{2}$$

$$c := \cos(\text{th})$$

$$s := \sin(\text{th})$$

$$c = 0$$

$$s = 1$$

$$\text{ut} := \left[\left[\left(\frac{1}{2} \right) \cdot (5 + \text{mu}) \cdot r^2 - a^2 \cdot b^2 \cdot \frac{(1 + \text{mu})}{2 \cdot r^2} \right] + (a^2 + b^2) \cdot [(1 - \text{mu}) \cdot \log(r) - (1 + \text{mu})] \right] \cdot c - (a^2 + b^2) \cdot (\text{th} - \pi) \cdot s - k \cdot c$$

$$\text{ut} := \text{ut} \cdot \frac{p}{(n \cdot E)}$$

$$\text{ut} = 0.005$$