(2.)

$$\begin{pmatrix} \sigma_{11} \\ \sigma_{22} \\ \tau_{12} \end{pmatrix} = \begin{bmatrix} \cos^2\theta & \sin^2\theta & 2\cos\theta\sin\theta \\ \sin^2\theta & \cos^2\theta & -2\cos\theta\sin\theta \\ -\cos\theta\sin\theta & \cos\theta\sin\theta & \cos^2\theta - \sin^2\theta \end{bmatrix} \begin{bmatrix} \sigma_{xx} \\ \sigma_{yy} \\ \tau_{xy} \end{bmatrix}$$

Material Axis

Stress Axis

Uniaxial Stress loading

↳ $\Rightarrow \sigma_{yy} = 0$

$\tau_{xy} = 0$

$$\begin{pmatrix} \sigma_{11} \\ \sigma_{22} \\ \sigma_{12} \end{pmatrix} = \begin{bmatrix} \sigma_{xx}\cos^2\theta \\ \sigma_{xx}\sin^2\theta \\ -\sigma_{xx}\cos\theta\sin\theta \end{bmatrix}$$

Tsai-wu Criterion → Also Applied in Matlab.

$$F_{11}\sigma_1^2 + F_{22}\sigma_2^2 + F_{66}\tau_{12}^2 + F_1\sigma_1 + F_2\sigma_2 + 2F_{12}\sigma_1\sigma_2 = 1$$

$\sigma_1 \Rightarrow \sigma_{xx}\cos^2\theta$

$\sigma_2 = \sigma_{xx}\sin^2\theta$

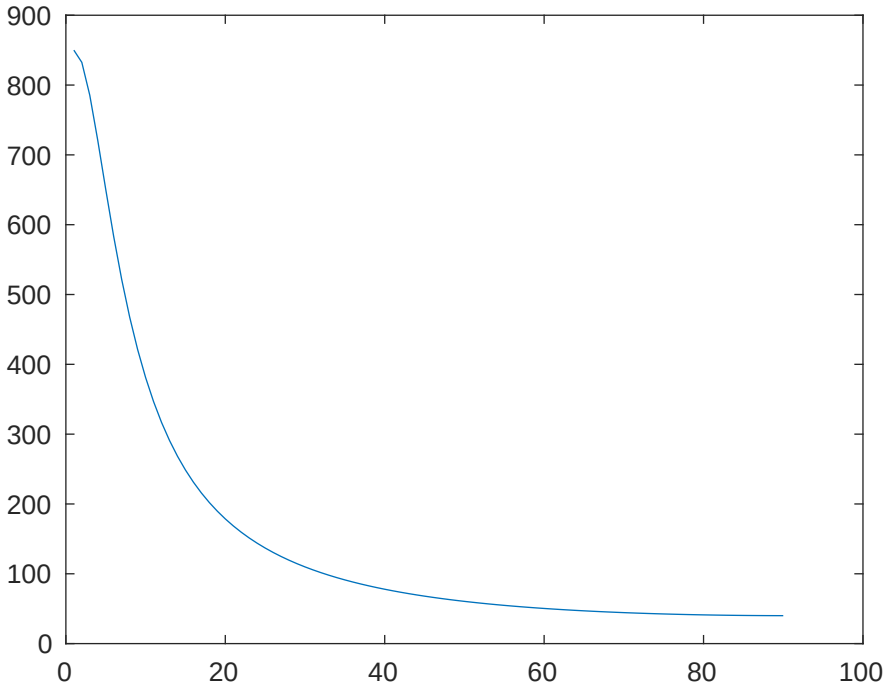
$\tau_{12} = -\sigma_{xx}\cos\theta\sin\theta$

$$\left(F_{11}\cos^4\theta + F_{22}\sin^4\theta + F_{66}\sin^2\theta\cos^2\theta\right)\times\sigma_{xx}^2 + \left(F_1\cos^2\theta + F_2\sin^2\theta\right)\times\sigma_{xx} + 2F_{12}\sin^2\theta\cos^2\theta\times\sigma_{xx}^2 = 1$$

$$A\sigma_{xx}^2 + B\sigma_{xx} - 1 = 0$$

Only Unknown = σ_{xx}, given theta.

Quadratic Eqn → Gives value of Maximum Stress for each θ


900
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100

```
theta = [0:1:90]; % In Degrees
theta = theta.*(pi/180); % Conversion to Radians - I my system Default is radians

sl_up = 850;
sl_down = 700;
st_up = 40;
st_down = 160;
tau = 75;

F11 = abs(1/(sl_up*sl_down));
F22 = abs(1/(st_down*st_up));
F66 = abs(1/(tau^2));
F1 = (1/sl_up - abs(1/sl_down));
F2 = (1/st_up - abs(1/st_down));
F12 = 0.5*sqrt(F11*F22);

max_stress = zeros(90,1);

for i=1:90
    A = F11*(cos(theta(i)))^4 + F22*(sin(theta(i)))^4 + (F66 +
2*F12)*((cos(theta(i)))^2)*((sin(theta(i)))^2);
    B = F1*(cos(theta(i)))^2 + F2*(sin(theta(i)))^2;
    C = -1;
    s = roots([A, B, C]);
    max_stress(i) = max(s);
end

plot(max_stress)
```