

$$\begin{array}{lcl}
h := 24 & & \\
b := 16 & \text{RC} := & \begin{pmatrix} -6.5 & 10.5 & 8 \\ 6.5 & 10.5 & 8 \\ 6.5 & -10.5 & 8 \\ -6.5 & -10.5 & 8 \\ -5 & 0 & 4 \\ 0 & 0 & 4 \\ 5 & 0 & 4 \end{pmatrix} & \begin{array}{ll} f_c := 3000 & \epsilon_{\text{cmax}} := 0.003 \\ f_y := 50000 & E_s := 29000000 \\ e_x := 5 & e_y := 20 \end{array}
\end{array}$$



$$\beta(f_c) := \left| \begin{array}{l} R \leftarrow 0.85 \text{ if } f_c \leq 4000 \\ R \leftarrow 0.65 \text{ if } f_c \geq 8000 \\ R \leftarrow 0.65 + (8000 - f_c) \cdot 0.00005 \text{ otherwise} \end{array} \right.$$

$$M'(M, \Delta x, \Delta y, \theta) := \left| \begin{array}{l} R \leftarrow \text{augment}(M^{\langle 0 \rangle} - \Delta x, M^{\langle 1 \rangle} - \Delta y) \\ R \leftarrow \text{augment}\left[R \cdot \begin{pmatrix} \cos(-\theta) \\ \sin(-\theta) \end{pmatrix}, R \cdot \begin{pmatrix} -\sin(-\theta) \\ \cos(-\theta) \end{pmatrix}\right] \end{array} \right.$$

$$\begin{array}{lcl}
\text{DNT}(\theta) := \left| \begin{array}{l} t \leftarrow \left| \begin{array}{l} 1 \text{ if } b \cdot \sin(\theta) \leq h \cdot \cos(\theta) \\ 2 \text{ otherwise} \end{array} \right. \\ d_1 \leftarrow \min(b \cdot \sin(\theta), h \cdot \cos(\theta)) \\ d_2 \leftarrow \max(b \cdot \sin(\theta), h \cdot \cos(\theta)) \\ d_3 \leftarrow \left| \begin{array}{l} b \cdot \sin(\theta) + d_2 \text{ if } t = 1 \\ h \cdot \cos(\theta) + d_2 \text{ otherwise} \end{array} \right. \\ (d_1 \ d_2 \ d_3 \ t)^T \end{array} \right. & \text{Case}_1(d, \theta) := & \left| \begin{array}{l} a \leftarrow \frac{d^2}{2} \cdot \left( \frac{1}{\tan(\theta)} + \tan(\theta) \right) \\ c_x \leftarrow \frac{b}{2} - \frac{d}{3 \cdot \sin(\theta)} \\ c_y \leftarrow \frac{h}{2} - \frac{d}{3 \cdot \cos(\theta)} \\ (c_x \ c_y \ a)^T \end{array} \right.
\end{array}$$

$$\text{Case}_2(d, \theta, t) := \left| \begin{array}{l} \text{if } t = 1 \\ \left| \begin{array}{l} a \leftarrow \frac{d \cdot b}{\cos(\theta)} \\ c_x \leftarrow 0 \\ c_y \leftarrow \frac{h}{2} - \frac{b \cdot \tan(\theta) + \frac{d}{\cos(\theta)}}{2} \end{array} \right. \\ \text{otherwise} \\ \left| \begin{array}{l} a \leftarrow \frac{d \cdot h}{\sin(\theta)} \\ c_y \leftarrow 0 \\ c_x \leftarrow \frac{b}{2} - \frac{\left( \frac{h}{\tan(\theta)} + \frac{d}{\sin(\theta)} \right)}{2} \end{array} \right. \\ (c_x \quad c_y \quad a)^T \end{array} \right.$$

$$\text{Case}_3(d, \theta, d_2, d_3) := \left| \begin{array}{l} m_1 \leftarrow d_3 - d_2 \\ m_2 \leftarrow m_1 - d \\ a_1 \leftarrow \frac{m_1^2}{2} \left( \tan(\theta) + \frac{1}{\tan(\theta)} \right) \\ a_2 \leftarrow \frac{m_2^2}{2} \left( \tan(\theta) + \frac{1}{\tan(\theta)} \right) \\ a \leftarrow a_1 - a_2 \\ c_x \leftarrow \frac{-b}{2} + \frac{1}{3 \cdot \sin(\theta) \cdot a} (a_1 \cdot m_1 - a_2 \cdot m_2) \\ c_y \leftarrow \frac{-h}{2} + \frac{1}{3 \cdot \cos(\theta) \cdot a} (a_1 \cdot m_1 - a_2 \cdot m_2) \\ (c_x \quad c_y \quad a)^T \end{array} \right.$$

$$C_{\text{ryp}}(d, \theta) := \begin{array}{|l} \text{dnt} \leftarrow \text{DNT}(\theta) \\ \text{d}_1 \leftarrow \text{dnt}_0 \\ \text{d}_2 \leftarrow \text{dnt}_1 \\ \text{d}_3 \leftarrow \text{dnt}_2 \\ \text{t} \leftarrow \text{dnt}_3 \\ \text{x} \leftarrow \min(d, \text{d}_1) \\ \text{cca} \leftarrow \text{Case}_1(\text{x}, \theta) \\ \text{if } d > \text{d}_1 \\ \quad \left| \begin{array}{l} \text{x} \leftarrow \min(d - \text{d}_1, \text{d}_2 - \text{d}_1) \\ \text{cca} \leftarrow \text{augment}(\text{cca}, \text{Case}_2(\text{x}, \theta, \text{t})) \end{array} \right. \\ \text{if } d > \text{d}_2 \\ \quad \left| \begin{array}{l} \text{x} \leftarrow \min(d - \text{d}_2, \text{d}_3 - \text{d}_2) \\ \text{cca} \leftarrow \text{augment}(\text{cca}, \text{Case}_3(\text{x}, \theta, \text{d}_2, \text{d}_3)) \end{array} \right. \\ \text{xya} \leftarrow \text{cca}^T \\ \text{R} \leftarrow \text{augment}\left(\text{submatrix}(\text{xya}, 0, \text{rows}(\text{xya}) - 1, 0, 1), \text{xya}^{\langle 2 \rangle} \cdot -0.85 \cdot f_c\right) \\ \text{R} \end{array}$$

$$R_{\text{ryp}}(d, \theta) := \begin{array}{|l} \text{x} \leftarrow \frac{d}{\beta(f_c)} \\ \text{RC}_L \leftarrow M'\left(\text{RC}, \frac{b}{2}, \frac{h}{2}, \theta\right) \\ \text{RC}_L \leftarrow M'(\text{RC}_L, 0, -\text{x}, 0) \\ \sigma \leftarrow \frac{-(\text{RC}_L)^{\langle 1 \rangle}}{\text{x}} \cdot \epsilon_{\text{cmax}} \cdot E_s \\ \text{for } i \in 0 \dots \text{rows}(\sigma) - 1 \\ \quad \left| \begin{array}{l} \sigma_{s_i} \leftarrow \min(|\sigma_i|, f_y) \cdot \text{sign}(\sigma_i) \\ \sigma_{s_i} \leftarrow \sigma_{s_i} + 0.85 \cdot f_c \text{ if } \text{RC}_{L_{i,1}} > \text{x} - d \end{array} \right. \\ \text{p} \leftarrow \left[ \overrightarrow{\sigma_s \cdot (\text{RC}^{\langle 2 \rangle})^2} \right] \cdot \frac{\pi}{256} \\ \text{R} \leftarrow \text{augment}(\text{submatrix}(\text{RC}, 0, \text{rows}(\text{RC}) - 1, 0, 1), \text{p}) \\ \text{R} \end{array}$$

$$\text{pmxy}(d, \theta) := \left| \begin{array}{l} c \leftarrow C_{\text{xyp}}(d, \theta) \\ r \leftarrow R_{\text{xyp}}(d, \theta) \\ \text{xyp} \leftarrow \text{stack}(r, c) \\ \sum \text{xyp}^{\langle 2 \rangle} \\ R_0 \leftarrow \frac{\quad}{1000} \\ R_1 \leftarrow \frac{\text{xyp}^{\langle 1 \rangle T} \cdot \text{xyp}^{\langle 2 \rangle}}{12000} \\ R_2 \leftarrow \frac{\text{xyp}^{\langle 0 \rangle T} \cdot \text{xyp}^{\langle 2 \rangle}}{12000} \\ R \end{array} \right|$$

$$\text{Rep}_{\text{xy}} := \left| \begin{array}{l} i \leftarrow 0 \\ \text{for } j \in 1 \dots b \\ \quad \text{for } k \in 1 \dots h \\ \quad \left| \begin{array}{l} R_{i,0} \leftarrow j \\ R_{i,1} \leftarrow k \\ i \leftarrow i + 1 \end{array} \right| \\ R \end{array} \right|$$

$$\sigma_{\text{rxy}}(d, \theta) := \left| \begin{array}{l} x \leftarrow \frac{d}{\beta(f_c)} \\ RC_L \leftarrow M\left(RC, \frac{b}{2}, \frac{h}{2}, \theta\right) \\ RC_L \leftarrow M(RC_L, 0, -x, 0) \\ \frac{RC_L^{\langle 1 \rangle}}{x} \cdot \epsilon_{\text{cmax}} \cdot E_s \\ \text{for } i \in 0 \dots \text{rows}(\sigma) - 1 \\ \quad \sigma_{s_i} \leftarrow \min(|\sigma_i|, f_y) \cdot \text{sign}(\sigma_i) \\ R \leftarrow M\left(RC, \frac{-b}{2}, \frac{-h}{2}, 0\right) \\ R \leftarrow \text{augment}(R, \sigma_s) \\ \text{for } i \in 0 \dots \text{rows}(R) - 1 \\ \quad \left| \begin{array}{l} R_{i,0} \leftarrow \text{round}(R_{i,0}) \\ R_{i,1} \leftarrow \text{round}(R_{i,1}) \end{array} \right| \\ R \end{array} \right|$$

$$\sigma_{\text{cxy}}(d, \theta) := \left| \begin{array}{l} x \leftarrow \frac{d}{\beta(f)} \\ rm \leftarrow R\epsilon \\ rm_L \leftarrow r \\ rm_L \leftarrow M \\ rm_L \leftarrow M \\ \text{for } i \in ( \\ \quad \sigma_i \leftarrow | \\ R \leftarrow \text{aug} \\ R \end{array} \right|$$

$$\sigma\epsilon_{\text{plot}}(d, \theta) := \left| \begin{array}{l} \epsilon \leftarrow \epsilon_x \\ \sigma_c \leftarrow \sigma \\ \sigma_r \leftarrow \sigma \\ \text{for } i \in \\ \quad \left| \begin{array}{l} R(c \\ S_{f_c} \end{array} \right| \end{array} \right|$$

$$\sqrt{, 2 \quad , 2} \quad \lceil \quad , \quad , \quad \rceil$$

$$d_{\max} := \frac{\varepsilon_{\max} \cdot \sqrt{h^2 + b^2}}{\varepsilon_{\max} - \frac{f_y}{E_s}} \quad \theta := \operatorname{atan} \left[ \frac{e_x}{e_y} \cdot \left( \frac{h}{b} \right) \right] \quad d := d_{\max}$$

Given

$$0 < \theta < \frac{\pi}{2} \quad 0 < d < d_{\max}$$

$$\operatorname{pmxy}(d, \theta)_0 \cdot \frac{e_y}{12} = \operatorname{pmxy}(d, \theta)_1$$

$$\operatorname{pmxy}(d, \theta)_0 \cdot \frac{e_x}{12} = \operatorname{pmxy}(d, \theta)_2$$

$$na := \operatorname{Find}(d, \theta) \quad \underline{\underline{d}} := na_0 \quad \underline{\underline{\theta}} := na_1$$

$$pm := \operatorname{pmxy}(d, \theta)$$

$$\sigma \varepsilon := \sigma \varepsilon_{\text{plot}}(d, \theta)$$

$$\begin{pmatrix} P_{\max} & M_{rx} & M_{ry} \end{pmatrix} := \begin{pmatrix} pm_0 & pm_1 & pm_2 \end{pmatrix}$$

for  $i \in$

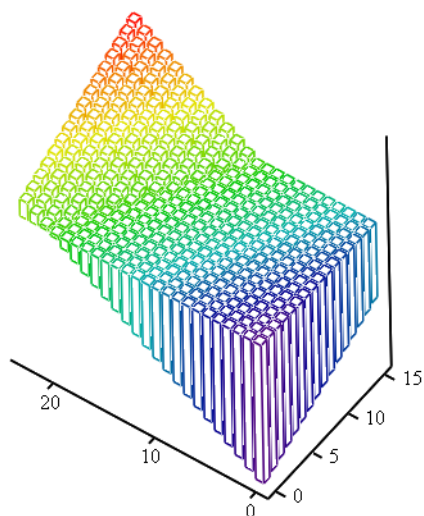
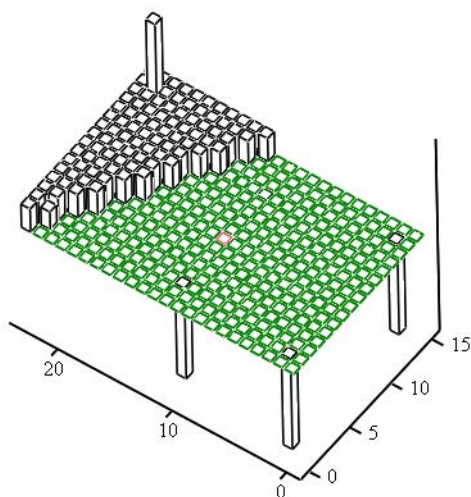
$R(\sigma_{r_i})$

$R \leftarrow R$

$S \leftarrow S$

$(R \ S)$

$$y(6, 2) = \begin{pmatrix} -6 & 10 & 5 \times 10^4 \\ P_{\max} = -154.6 & & \\ M_{rx} = -257.5 \times 10^4 & & \\ M_{ry} = -64.4 \times 10^4 & & \\ -6 & -10 & -4.294 \times 10^4 \end{pmatrix} \quad \begin{pmatrix} P_{\max} \cdot \frac{e_y}{12} = -257.7 \\ \sigma_{rxy}(6, 2) = \\ P_{\max} \cdot \frac{e_x}{12} = -64.4 \end{pmatrix} = \begin{pmatrix} -6 & 10 & 5 \times 10^4 \\ 6 & 10 & d = 8.574 \times 10^4 \\ 6 & -10 & \theta = 0.56 \\ -6 & -10 & -4.294 \times 10^4 \end{pmatrix}$$



$$\overline{f_c})$$

$$\mathcal{P}_{xy}$$

$$m-0.5$$

$$A'(rm,b,h,\theta)$$

$$A'(rm_L,0,-x,0)$$

$$) \dots rows(rm_L)-1$$

$$\left| \begin{array}{l} 0.85 \cdot f_c \text{ if } rm_{L,i,1} \geq x-d \\ 0 \text{ otherwise} \end{array} \right.$$

$$ment(rm,\sigma)$$

$$\varepsilon_{xy}(d,\theta) := \left| \begin{array}{l} x \leftarrow \frac{d}{\beta(f_c)} \\ rm \leftarrow Rep_{xy} \\ rm_L \leftarrow rm-0.5 \\ rm_L \leftarrow M'(rm,b,h,\theta) \\ rm_L \leftarrow M'(rm_L,0,-x,0) \\ \varepsilon \leftarrow \frac{rm_L^{\langle 1 \rangle} \cdot \varepsilon_{cmax}}{x} \\ R \leftarrow augment(rm,\varepsilon) \\ R \end{array} \right.$$

$$_{xy}(d,\theta)$$

$$r_{cxy}(d,\theta)$$

$$r_{rxy}(d,\theta)$$

$$0 \dots rows(\sigma_c)-1$$

$$r_{c_{i,0}-1},\left(\sigma_{c_{i,1}}-1\right) \leftarrow \sigma_{c_{i,2}}$$

$$r_{c_{i,0}-1},\left(\sigma_{c_{i,1}}-1\right) \leftarrow \varepsilon_{i,2}$$

$$i,0^{-i}), (c_i,1^{-i}) \qquad i, \in$$

$$0..rows\big(\sigma_r\big)-1$$

$$_{,0}^{-1}),\big(\sigma_{r_i,1}^{-1}\big)\leftarrow \frac{\sigma_{r_i,2}}{5}$$

$$\cdot \frac{h+b}{\max(R)\cdot 4}$$

$$\frac{h+b}{\max(S)\cdot 4}$$

$$\mathsf{T}$$

