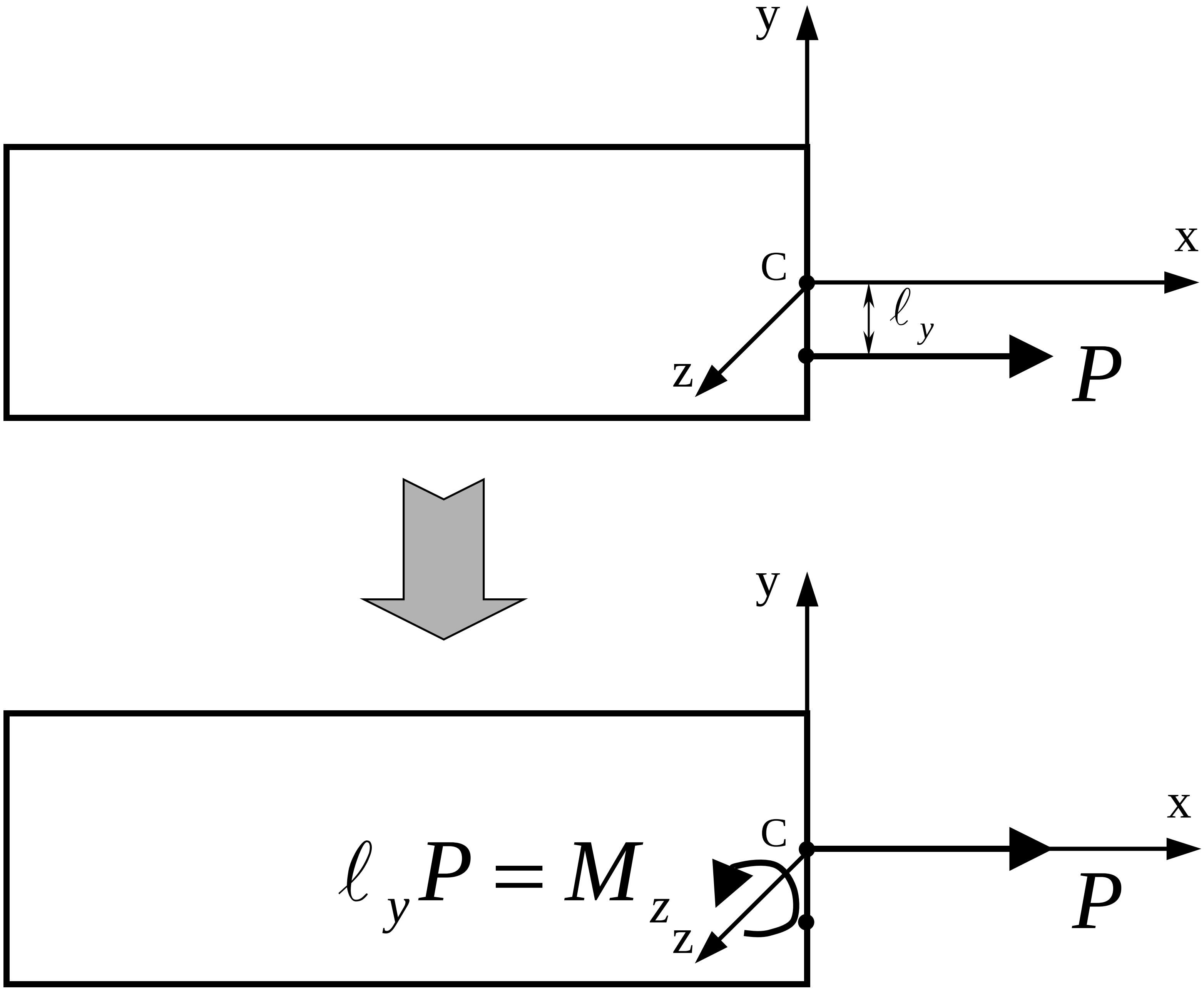
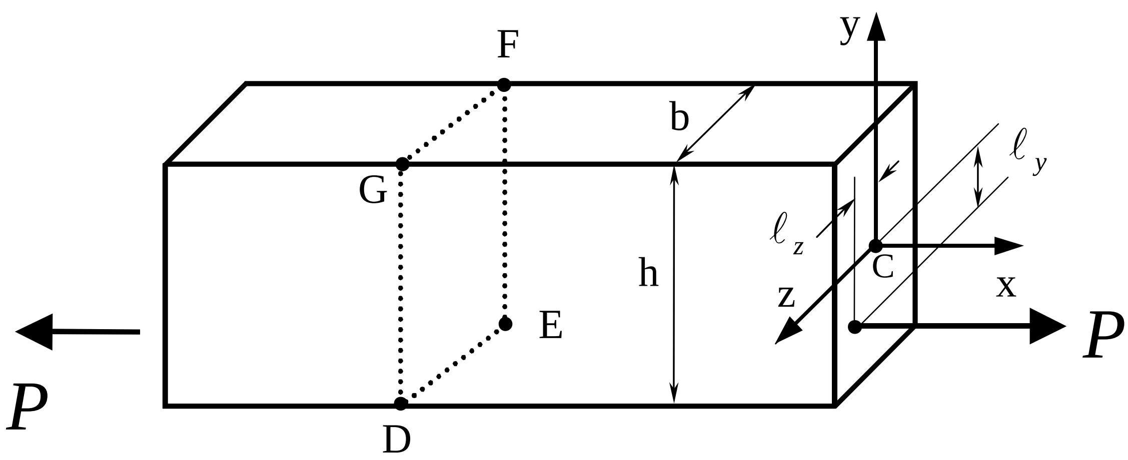

y
x
C
ℓ y
z
P
y
x
C
ℓ y P = M z
z
P

General Case of Eccentric Axial Loading



$$\vec{P} = +P\hat{i} \qquad \vec{\ell}_y = -\ell_y\hat{j} \qquad \vec{\ell}_z = \ell_z\hat{k}$$

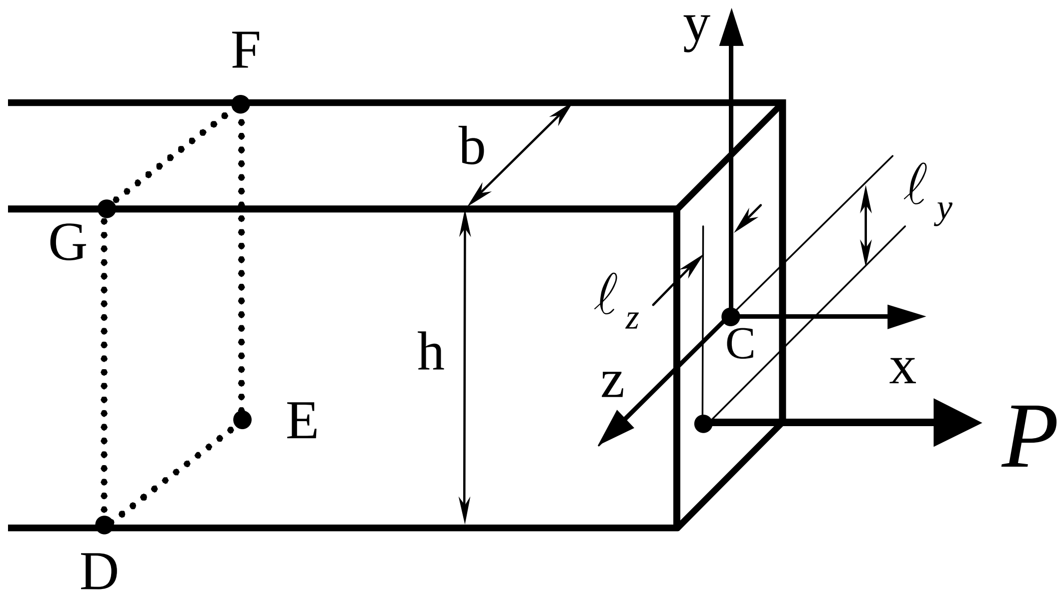
$$\vec{M}_z = \vec{\ell}_y \times \vec{P} = \left(-\ell_y\hat{j}\right)\times\left(P\hat{i}\right)$$

$$= -\ell_y P\left(\hat{j}\times\hat{i}\right) = -\ell_y P\left(-\hat{k}\right) = +\ell_y P\hat{k} = \vec{M}_z$$

$$\vec{M}_y = \vec{\ell}_z \times \vec{P} = \left(+\ell_z\hat{k}\right)\times\left(P\hat{i}\right)$$

$$= +\ell_z P\left(\hat{k}\times\hat{i}\right) = +\ell_z P\left(+\hat{j}\right) = +\ell_z P\hat{j} = \vec{M}_y$$

$$\sigma_x = \frac{P}{A} - \frac{M_z y}{I_z} + \frac{M_y z}{I_y}$$

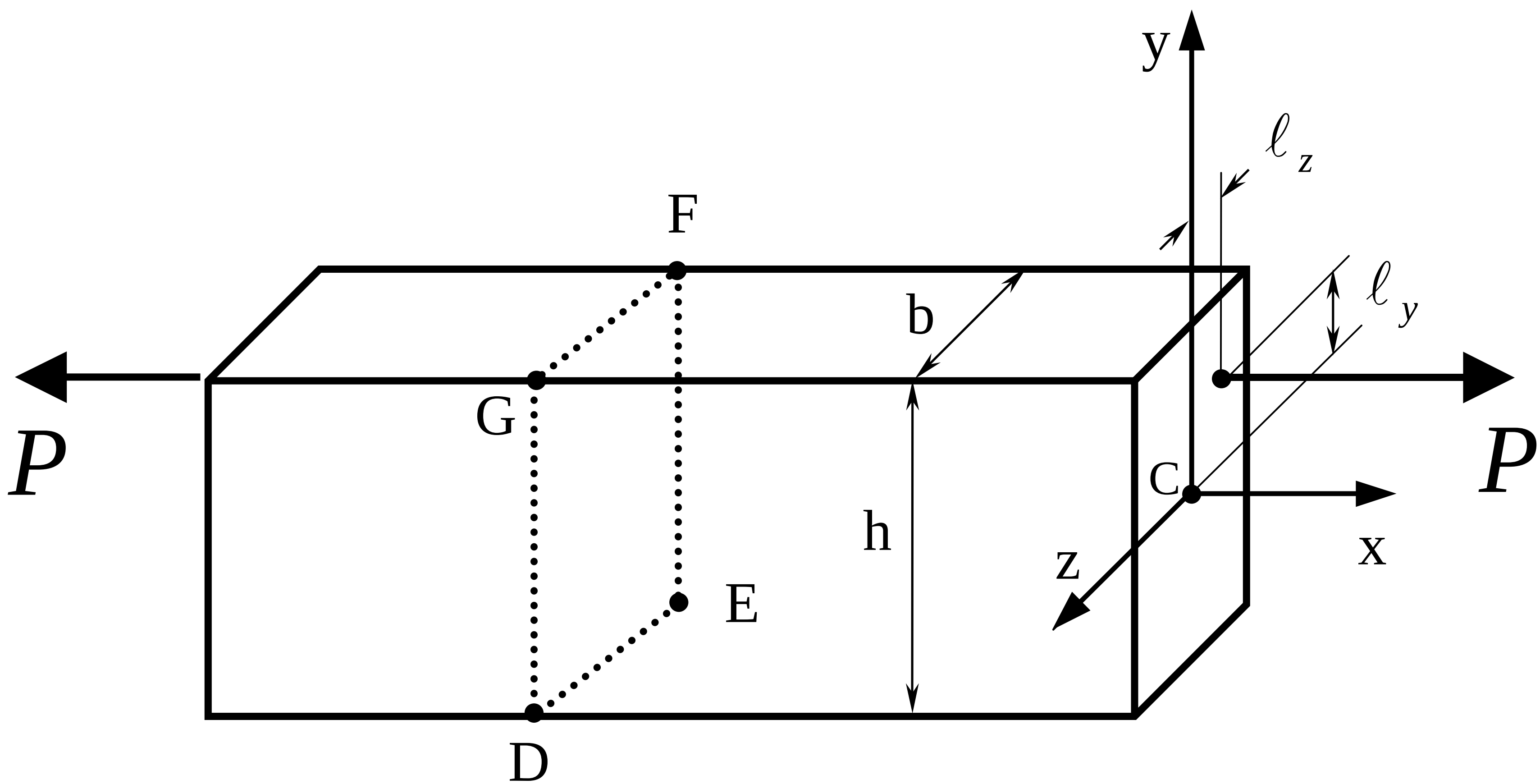


$$\vec{M}_z = +\ell_y P\hat{k} \qquad \vec{M}_y = +\ell_z P\hat{j}$$

$$\sigma_x = \sigma_1 + \sigma_2 + \sigma_3$$

$$\sigma_1 = \frac{P}{A} \qquad \sigma_2 = -\frac{M_z y}{I_z} \qquad \sigma_3 = +\frac{M_y z}{I_y}$$

	D	E	F	G
y				
z				
σ_1				
σ_2				
σ_3				



P
P
F
G
E
D
b
h
y
x
z
C
ℓ z
ℓ y