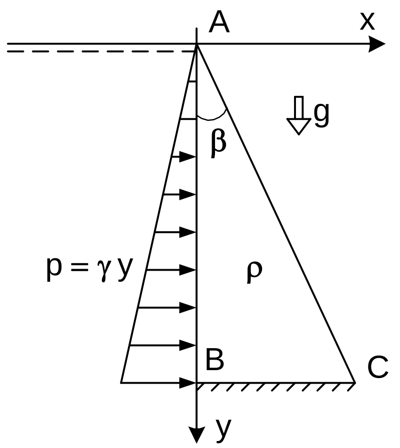

I.6. Oheinen kuva esittää padon kiilamaista poikkileikkausta. Padon materiaalin tiheys on ρ ja sen reunaan asti ulottuvan nesteen γ / g. Osoita, että kuvan xy-koordinaatistossa annetut jännityskomponentit

$$\sigma_x = -\gamma y$$
$$\sigma_y = (\rho g - 2\gamma / \tan^2\beta) x / \tan\beta + (\gamma / \tan^2\beta - \rho g) y$$
$$\tau_{xy} = -(\gamma / \tan^2\beta) x$$

toteuttavat jännityskomponenttien tasapainoyhtälöt ja reunaehdot sivuilla AB ja AC.

Ratkaisu:

$$\sigma_{x,x} = 0 \qquad \tau_{xy,y} = 0 \qquad f_x = 0 \qquad \Rightarrow \qquad \sigma_{x,x} + \tau_{xy,y} + f_x = 0 \qquad \text{OK}$$

$$\tau_{xy,x} = -\frac{\gamma}{\tan^2\beta} \qquad \sigma_{y,y} = \frac{\gamma}{\tan^2\beta} - \rho g \qquad f_y = \rho g \qquad \tau_{xy,x} + \sigma_{y,y} + f_y = 0 \qquad \text{OK}$$

Reunalla AB: $x = 0 \quad a = -1 \quad b = 0 \quad t_x = \gamma y \quad t_y = 0$

$$t_x = \sigma_x a + \tau_{xy} b \qquad \Rightarrow \qquad \gamma y = (-\gamma y) \cdot (-1) + 0 \cdot 0 \qquad \text{OK}$$

$$t_y = \tau_{xy} a + \sigma_y b \qquad \Rightarrow \qquad 0 = 0 \cdot (-1) + \left(\frac{\gamma}{\tan^2\beta} - \rho g \right) y \cdot 0 \qquad \text{OK}$$

Reunalla AC: $x = y\tan\beta \quad a = \cos\beta \quad b = -\sin\beta \quad t_x = 0 \quad t_y = 0$

$$t_x = \sigma_x a + \tau_{xy} b \qquad \Rightarrow \qquad 0 = (-\gamma y) \cdot \cos\beta + \left(-\frac{\gamma}{\tan^2\beta} y \tan\beta \right) \cdot (-\sin\beta) \qquad \text{OK}$$

$$t_y = \tau_{xy} a + \sigma_y b \qquad \Rightarrow$$

$$0 = \left(-\frac{\gamma}{\tan^2\beta} y\tan\beta \right) \cdot \cos\beta + \left[\left(\rho g - \frac{2\gamma}{\tan^2\beta} \right) \frac{y\tan\beta}{\tan\beta} + \left(\frac{\gamma y}{\tan^2\beta} - \rho g y \right) \right] \cdot (-\sin\beta) =$$

$$= -\frac{\gamma y \cos\beta}{\tan\beta} + \frac{\gamma y \sin\beta}{\tan^2\beta} = -\frac{\gamma y \cos\beta}{\tan\beta} + \frac{\gamma y \cos\beta}{\tan\beta} \qquad \Rightarrow \text{OK}$$