

Solutions

ASEN5012/MCEN5023 Mechanics of Solids - Fall 2007: Exam 2

Problem 1. (30 points) With the Airy stress function for a plane problem assumes the following form:

$$\phi(x, y) = \frac{a_3}{6}x^3 + \frac{b_3}{2}x^2y + \frac{c_3}{2}xy^2 + \frac{d_3}{6}y^3 \quad (1)$$

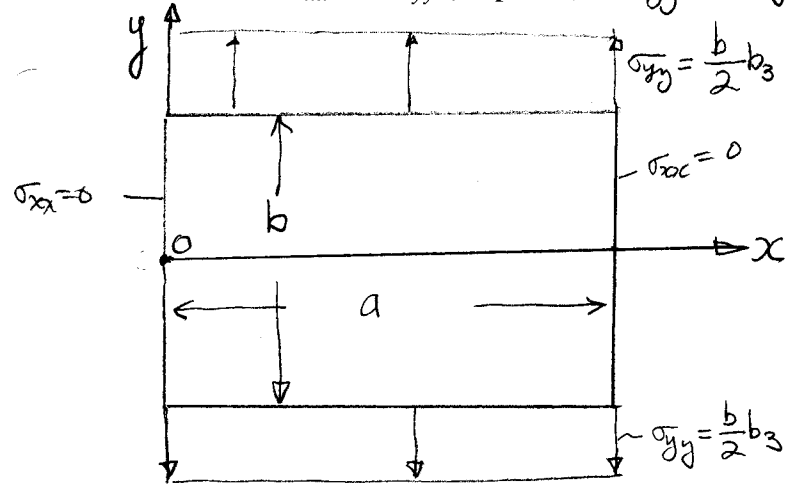
$$\sigma_{xx} = \frac{\partial^2 \phi}{\partial y^2}, \quad \sigma_{yy} = \frac{\partial^2 \phi}{\partial x^2}, \quad \sigma_{xy} = -\frac{\partial^2 \phi}{\partial x \partial y}$$

draw the boundary stress states of the following cases on a rectangle ($0 \leq x \leq a$, $-b/2 \leq y \leq b/2$) for the case of ($b_3 > 0$, $a_3 = c_3 = d_3 = 0$).

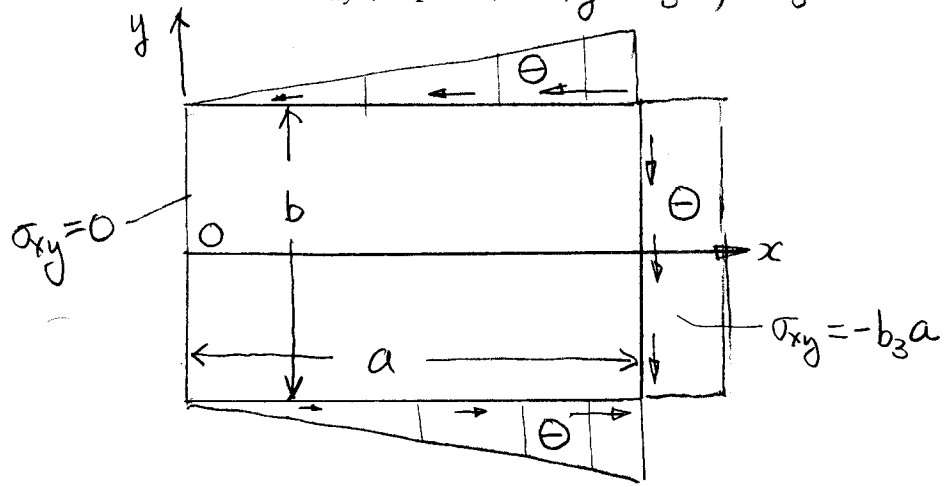
$$\left. \begin{aligned} \sigma_{xx} &= c_3 x + d_3 y \\ \sigma_{yy} &= a_3 x + b_3 y \\ \sigma_{xy} &= -(b_3 x + c_3 y) \end{aligned} \right\}$$

for $b_3 > 0$, $a_3 = c_3 = d_3 = 0$
we have
 $\sigma_{xx} = 0$, $\sigma_{yy} = b_3 y$
 $\sigma_{xy} = -b_3 x$

Draw here σ_{xx} and σ_{yy} (15 points) $\sigma_{yy} = b_3 y$



Draw here σ_{xy} (15 points) $\sigma_{xy} = -b_3 x$, $b_3 > 0$



They are all negative
positive σ_{xy} -convention

