SOLUTION (2.5)

Equation (2.8) yields

$$2a_1 + 12y^2 + 2b_1 + 12x^2 = 3c_1(x^2 + y^2) + c_1c_2$$

Solving,

$$c_1 = 4 \qquad c_2 = \tfrac{1}{2}(a_1 + b_1)$$

SOLUTION (2.6)

(a) Equations (2.3) give

$$\varepsilon_x = \frac{\partial u}{\partial x} = \frac{0.175-0.075}{150} = 667\ \mu$$

$$\varepsilon_y = \frac{\partial v}{\partial y} = \frac{0.025-(-0.05)}{100} = 750\ \mu$$

and

$$\gamma_{xy} = \frac{0-0.075}{100} + \frac{[-0.125-(-0.05)]}{150} = -1250\ \mu$$

(b) Equation (2.13) is therefore

$$\varepsilon_{1,2} = \frac{667+750}{2} \pm \left[\left(\frac{667-750}{2}\right)^2 + 625^2\right]^{\frac{1}{2}}$$

or

$$\varepsilon_1 = 1335\ \mu \qquad \varepsilon_2 = 82\ \mu$$

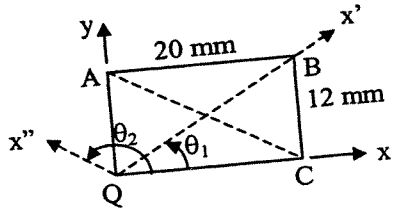
When

$$\theta_p = \tfrac{1}{2}\tan^{-1}\frac{-1250}{667-750} = 43.1^o$$

and stresses are substituted into Eq. (2.11a), we obtain $\varepsilon_{x'} = 82\ \mu$. Thus,

$$\theta_p'' = 43.1^o$$

SOLUTION (2.9)



We have, from geometry:

$$AC = QB = 23.32\ mm$$

$$\theta_1 = 30.96^o \qquad \theta_2 = 149.04^o$$

Equation (2.11a) leads to

$$\varepsilon_{x'} = \frac{300+500}{2} + \frac{300-500}{2}\cos 61.92^o + 100\sin 61.92^o = 441\ \mu$$

Thus,

$$\Delta_{QB} = 441\,\mu(23.32) = 0.01\ mm$$

Similarly,

$$\varepsilon_{x''} = 400 - 100\cos 298.08^o + 100\sin 298.08^o = 265\ \mu$$

and

$$\Delta_{AC} = 265\,\mu(23.32) = 0.006\ mm$$