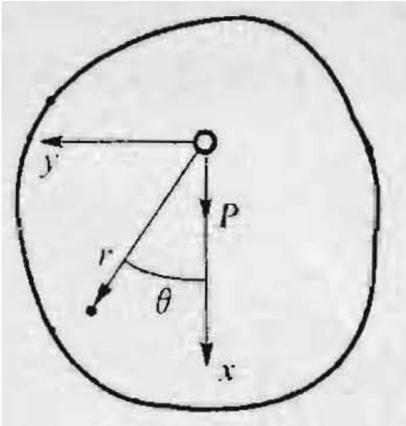
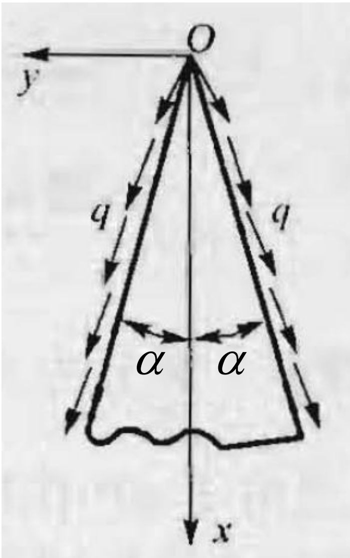
1. For a concentrated force applied on a small circular hole inside an infinite thin-plate, investigate the suitability of the following Airy Stress Function

$$\psi = Ar\ln r\cos\theta + Br\theta\sin\theta,$$

where A and B are constants to be determined from force equilibrium and single-valued displacement condition.



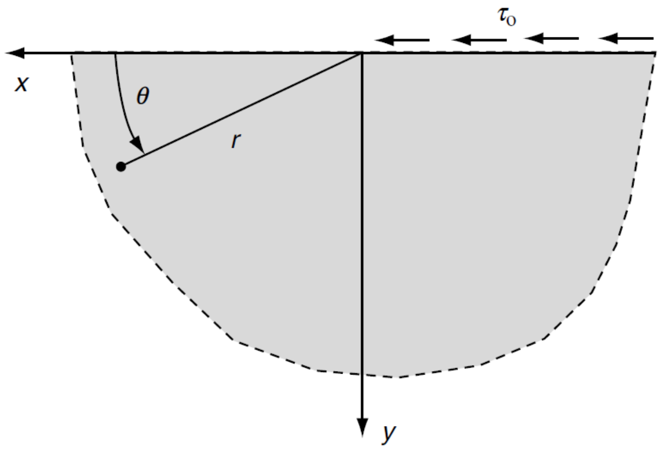
2. Determine the stresses in a wedge subjected to uniform shear on both lateral surface $\theta = \pm\alpha$, as shown below.



3. Show that the Airy Stress Function

$$\psi = \frac{\tau_0 r^2}{\pi}\left[\sin^2\theta \ln r + \theta \sin\theta \cos\theta - \sin^2\theta\right],$$

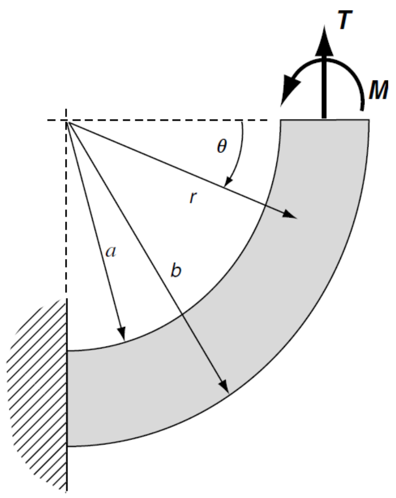
gives the solution to the problem of an elastic half space loaded by a uniformly distributed shear over the free surface ($x \leqslant 0$), as shown in the figure. Identify locations where the stresses are singular.



4. Show that the curved beam problem with the special end loadings $M = -T(a+b)/2$ can be solved by the Airy stress function

$$\psi = \left[Ar^3 + \frac{B}{r} + Cr + Dr\ln r\right]\cos\theta.$$

As a result, the solution for an arbitrary end moment may be generated by superimposing this solution with the pure bending solution developed in class.



5. For the problem of a half space under uniform normal loading as shown in the left figure, show that the maximum shear stress (the radius of Mohr's circle) can be expressed by

$$\tau_{\max} = \frac{p}{\pi}\sin\left(\theta_1 - \theta_2\right).$$

Plot the distribution of lines of constant maximum shear stress, and compare the results with the photoelastic fringes shown in the right figure.