MOOC – "Mechanics of Materials II"
Section One Quiz

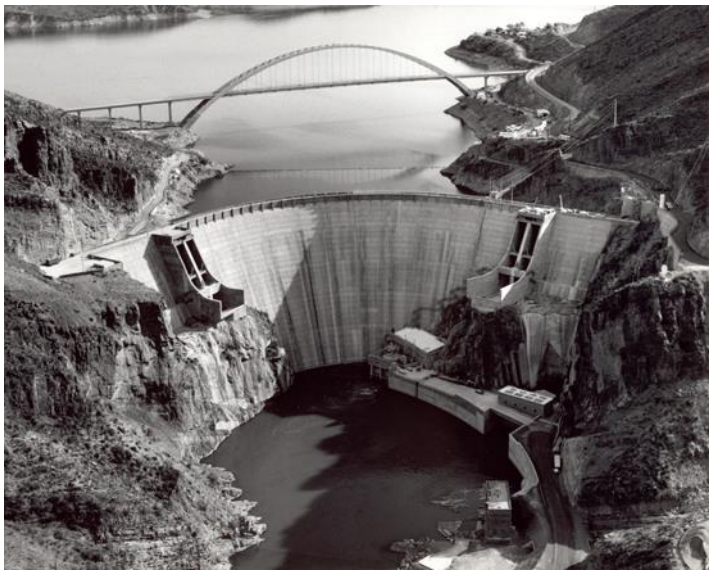
Problem 1) Assume that a soccer ball can be treated as a spherical pressure vessel. The diameter of the soccer ball is 22 cm. Its wall thickness is 2 mm and it has been inflated to a gage pressure of 60 kilopascals. Determine the maximum normal stress on a plane perpendicular to the surface of the ball.

$$\sigma_{LONG} = \frac{pD}{4t} = \frac{60\,KPa\,(22\,cm)\left(\frac{10\,mm}{1\,cm}\right)}{4(2\,mm)}$$

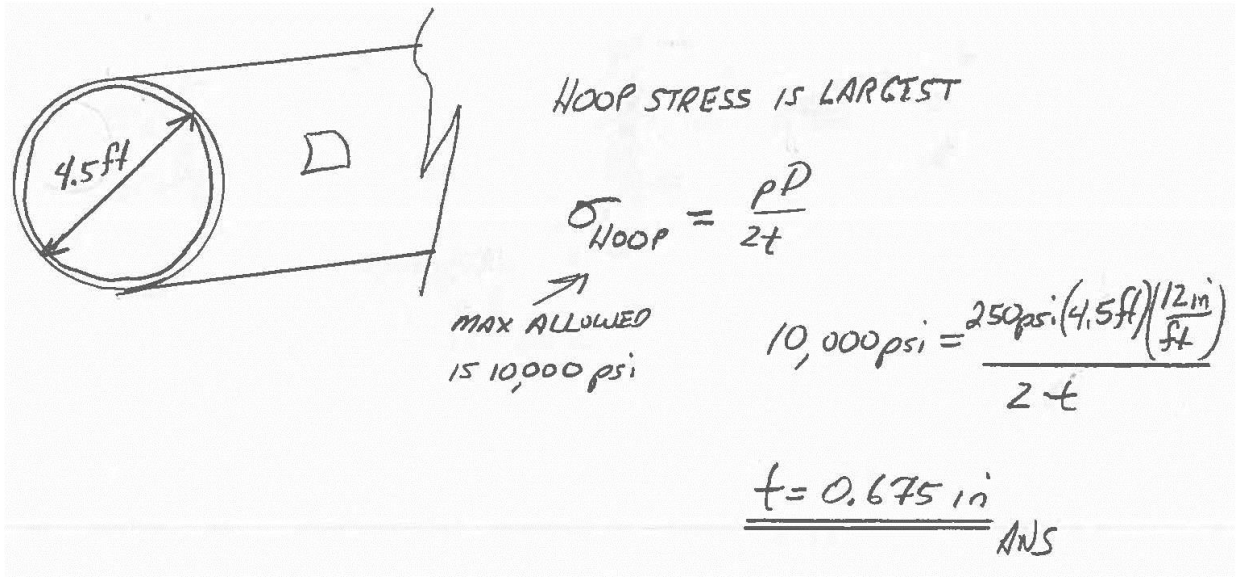
$$\sigma_{LONG} = 1650\,KPa = 1.65\,MPa$$

ANS

Problem 2) A discharge pipe for the Roosevelt Dam in Arizona (shown below) is subjected to a maximum internal pressure of 250 psi. The diameter of the pipe is 4.5 feet. The maximum tensile stress that can be exerted on the material used in in fabrication of the pipe is 10,000 psi. What thickness of the pipe is required for the pipe walls?



By J. Madrigal, Jr. [Public domain], via Wikimedia Commons

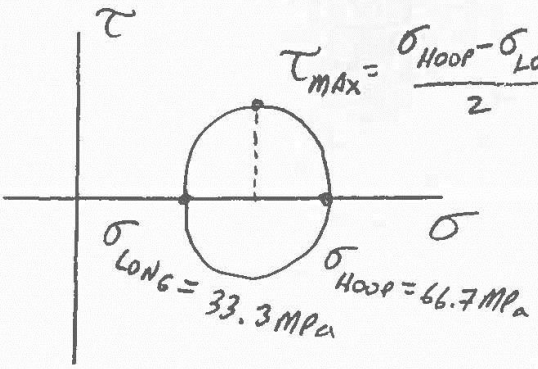


Problem 3) A cylindrical tank containing compressed air has hemispherical ends. The tank has a one meter diameter and a wall thickness of 6 mm. The tank is subjected to an internal pressure of 0.8 MPa.
Determine the maximum normal and maximum in-plane shear stresses on a plane perpendicular to the surface of the tank.

$$\sigma_{HOOP} = \frac{pD}{2t} = \frac{0.8\,MPa\,(1000\,mm)}{2\,(6\,mm)} = 66.7\,MPa$$

$$\sigma_{LONG} = \frac{pD}{4t} = \frac{0.8\,MPa\,(1000\,mm)}{4\,(6\,mm)} = 33.3\,MPa$$

MOHR'S CIRCLE



$$\tau_{MAX} = \frac{\sigma_{HOOP} - \sigma_{LONG}}{2} = 16.7\,MPa$$

MAX NORMAL STRESS = 66.7 MPa ANS

MAX SHEAR STRESS = 16.7 MPa ANS.