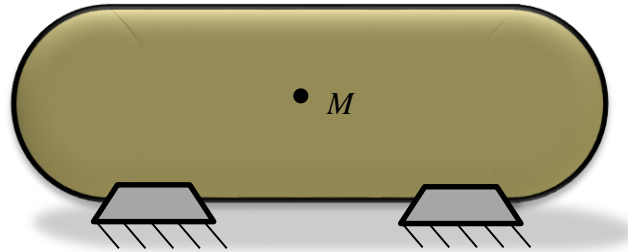


6-1. The internal pressure of a gas tank is  $p \sim N(70, 7^2)$  psi. The tank has an internal diameter of 18 in, and the wall thickness is 0.2 in. Determine the distribution of the Hoop stress and Longitudinal stress developed at point  $M$ , which is on the wall of the tank.



**Solution:**

**Hoop Stress:** Since  $\frac{r}{t} = \frac{(18/2)}{0.2} = 45 > 10$ , then thin wall analysis can be used. Thus, the hoop stress is

$$s_1 = \frac{pr}{t} = 45p$$

Since  $p \sim N(70, 7^2)$  psi,  $s_1$  also follows a normal distribution, and

$$\mu_{s_1} = 45\mu_p = 45(70) = 3150 \text{ psi}$$

$$\sigma_{s_1} = 45\sigma_p = 45(7) = 315 \text{ psi}$$

Thus,  $s_1$  follows a normal distribution  $s_1 \sim N(3150, 315^2)$  psi.

**Ans.**

**Longitudinal stress:**

$$s_2 = \frac{pr}{2t} = 22.5p$$

Thus,  $s_2$  also follows a normal distribution, and

$$\mu_{s_2} = 22.5\mu_p = 22.5(70) = 1575 \text{ psi}$$

$$\sigma_{s_2} = 22.5\sigma_p = 22.5(7) = 157.5 \text{ psi}$$

Thus,  $s_2$  follows a normal distribution  $s_2 \sim N(1575, 157.5^2)$  psi.

**Ans.**