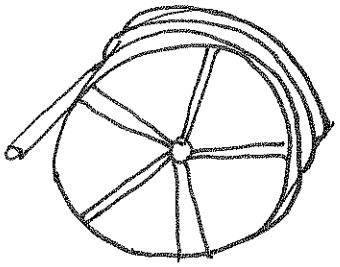
11.23. Solution

Straight rods $d = 0.30$ in, $\ell = 200$ ft made of high-strength steel wrapped around spool.

$D_{spool} = 5$ ft, $E_{steel} = 29 \cdot 10^6$ psi



Find σ_{max}, M.

ρ = radius of curvature = 2.5 ft

$$\rho = \frac{EI}{M} \quad ; \quad I = \frac{\pi c^4}{4} = \frac{\pi (.015\text{ in})^4}{4}$$

$$\rightarrow 2.5\text{ft} = \frac{(29 \cdot 10^6 \text{ psi})(\pi (.015\text{ in})^4)}{4M}$$

$$\Rightarrow \boxed{M = .038 \text{ kip-in}}$$

$$\sigma = -\frac{My}{I}$$ max σ occurs at max distance from neutral axis

$$\sigma = -\frac{.038 \text{ kip-in}\ (\pm .015\text{ in})}{\left(\frac{\pi (.015\text{ in})^4}{4}\right)} = \boxed{\pm 14.3 \text{ ksi}}$$