Threaded fastener
- Bolt joint

Power screw

$$\text{Tr} = \frac{Fdm}{2} \left( \frac{e + \pi d_m \text{sec} \alpha}{\pi d_m - \mu C \text{sec} \alpha} \right) + \frac{F N d_c}{2}$$

Bolt joint

$$c = \frac{P_o}{F_0} = \frac{F_k}{2\pi}$$

$$P < \frac{K_0 + K_m}{K_m} F_k \quad \text{max. allowable } P$$

$$F_k > \frac{K_m}{K_0 + K_m} \quad \text{min. preload } F_k$$

Today:

- Example on power screw
  - bolt joint $F_b$, $K_m$
  - load factors
  - $F_b = F_k + cP$
  - $F_m = -F_k + (1-c)P$
A bolt loaded by an axial tensile force of 4000 lb needs to be tightened with a specified torque. The bolt is a 3/8-16 UNF x 2.25" SAE grade 5. The bolt is cast iron, and its linear modulus of elasticity is $E = 16 \times 10^6$ psi.

**Solution:**

1. **Determine $n_2$ and $n_3$**

2. **Torque to be applied to tighten the bolt.**

**Thread Length Calculation:**

- Thread length, $L_T = 2D + \frac{L}{2} = 2(0.75) + \frac{2.25}{2} = 1.75$ in

**Area and Diameter Calculation:**

- $A_t = 0.373$ in

**Effective Diameter and Cross-Sectional Area Calculation:**

- $A_d = \frac{1}{2} \pi d^2 = 0.4418$ in$^2$

**Length Calculations:**

- $L_d = L - L_T = 2.5 - 1.75 = 0.75$ in (unthreaded portion)

**Net Length Calculation:**

- $L_T = L - L_d = 1.5 - 0.75 = 0.75$ in (threaded portion of grip)

**Torque Calculation:**

- $T = 10^5 \frac{F_T}{n_3} = 10^5 \frac{0.9 \cdot A_c \cdot E_c}{n_3} = 10^5 \frac{0.9 \cdot 0.373 \cdot 85}{3.05} = 28,531.6 \text{ lb-in}$

**Additional Calculations:**

- $n_4 = \frac{F_4}{E_c} = 3.05$

**Final Torque:**

- $T = 0.2 \times 28,531.6 \times 0.75 = 422.95 \text{ lb-in}$