

32. A torque  $T \sim N(80, 8^2)$  lbf·in is applied to the central portion of the span of a torsion bar. The bar has a round cross section with a diameter  $d \sim N(2, 0.02^2)$  in and has a length of  $l \sim N(20, 0.2^2)$  in. The shear modulus of the bar is  $G = 15$  Mpsi. What is the mean and standard deviation of the spring rate using the First Order Second Moment Method? Assume that  $d$ ,  $l$  and  $T$  are independent.

**Answer:**  $\mu_k = 4.7124(10^6)$  lbf·in/rad,  $\sigma_k = 1.9430(10^5)$  lbf·in/rad