

60. A torsion bar  $AB$  fixed at  $A$  is simply supported at  $B$  and is connected to a cantilever  $BC$  as shown in the figure. A force  $F \sim N(1500, 100^2)$  N is applied at  $C$ . Bar  $AB$  has a spring rate of  $k_1 \sim (3 \times 10^5, (3 \times 10^4)^2)$  N·m/rad and a length of  $l_1 \sim N(0.8, 0.001^2)$  m. Cantilever  $BC$  has a spring rate of  $k_2 \sim (5 \times 10^4, (5 \times 10^3)^2)$  N/m. If the allowable deflection at  $C$  is  $\delta_a = 0.05$  m and the maximum probability of failure is designed to be  $p_f = 10^{-5}$ , determine the maximum length of  $BC$  using First Order Second Moment Method. Assume that  $F$ ,  $l_1$  and  $l_2$  are independent.

**Answer:**  $l_{BC} = 0.883$  m

