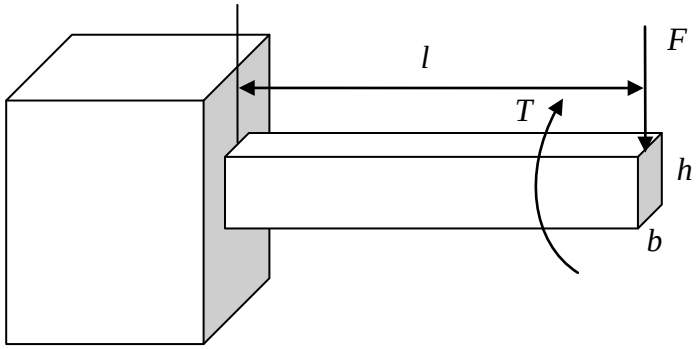
Homework 9
Reliability-Based Design

1. RBD with direct reliability analysis

The design margin of a beam is given by

$$g = S - \sqrt{\left(\frac{6Fl}{bh^2}\right)^2 + 3\left[\frac{T}{hb^2}\left(3+\frac{1.8b}{h}\right)\right]^2}$$

where F is the external force, T is the external torque, and S is the yield strength. The equation represents the difference between the yield strength and the maximum equivalent stress.



The distributions of random variables and the lower and upper bounds of design variables are given in the following table.

Variables	Mean	Std	Distribution	Lower bound	Upper bound
b	Deterministic design variable			0.1 in	0.4 in
h	Deterministic design variable			0.1 in	0.8 in
l	Deterministic design variable			2 in	20 in
F	300 lb	30 lb	Normal	---	---
T	450 lb-in	50 lb-in	Normal	---	---
S	100 kpsi	10 kpsi	Normal	---	---

Minimize the volume of the beam with required reliability 0.999. Use FOSM for reliability analysis.

(1) Provide the RBD model.
(2) Provide the result.
(3) Attach your source code.

2. RBD with inverse reliability analysis

Solve the above problem using inverse reliability analysis.

(1) Provide the RBD model.
(2) Provide the result.
(3) Attach your source code.