

CEE518 HW#5 Due on Monday November 14th

- 1) Problem 7.1 from the text.
- 2) The moment capacity for a singly-reinforced rectangular prismatic concrete beam is given by

$$M_R = A_s f_y d \left[1 - \eta \frac{A_s f_y}{bd f'_c} \right]$$

A_s \equiv area of tension reinforcing bars

f_y \equiv yield stress of the rebars

d \equiv distance from the extreme compression fiber to the centroid of the tension rebars

η \equiv the concrete stress block parameter,

f'_c \equiv compressive strength of concrete

b \equiv width of the compression face of the member

From Haldar & Mahadevan: Table 7.5 Uncertainty in the Design Parameters of a Reinforced Concrete Beam (p. 218)

Random variables	Mean	Coefficient of variation
A_s [in ²]	1.56	0.036
f_y [ksi]	47.7	0.15
f'_c [ksi]	3.5	0.21
b [inches]	8.0	0.045
d [inches]	13.2	0.086
η [inches]	0.59	0.05
M (kip-in)	326.25	0.17

For the limit state $Y = g(X) = M_R - M$, develop a computer program to produce the following results as given in Table 7.6, shown below:

Random Variables	Probability Distributions	
	Normal	Lognormal
A_s [in ²]	Normal	Lognormal
f_y [ksi]	Normal	Lognormal
f'_c [ksi]	Normal	Lognormal
b [inches]	Normal	Lognormal
d [inches]	Normal	Lognormal
η [inches]	Normal	Lognormal
M [kip-in]	Normal	Lognormal
β	3.833	4.091

- 3) Use Monte Carlo simulation to solve problem 2 with 50 cycles for all normal variables ONLY to obtain the reliability index. Compare with the value shown in Table 7.6.