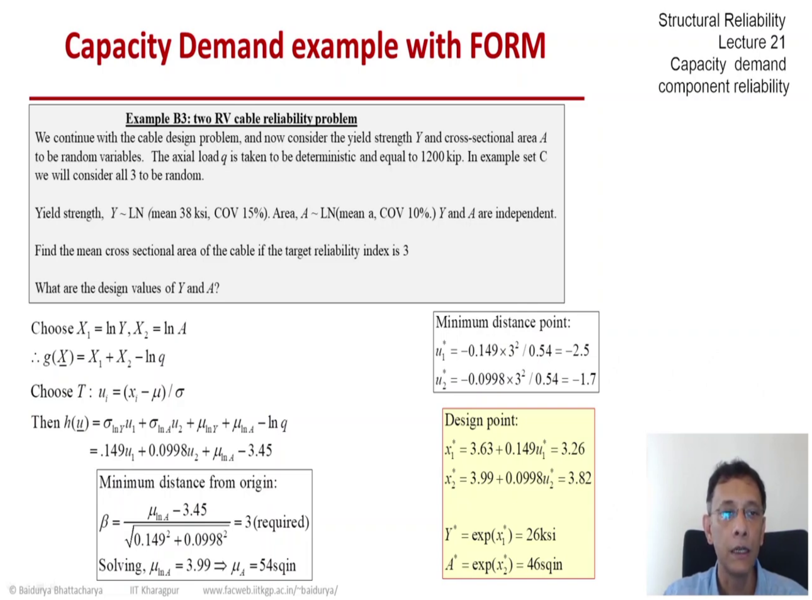
Structural Reliability
Prof. Baidurya Bhattacharya
Department of Civil Engineering
Indian Institute of Technology, Kharagpur

Lecture –170
Capacity Demand Component Reliability (Part 18)

(Refer Slide Time: 00:27)



In example B3 we continue with the same cable reliability problem but with a twist it is still a two random variable problem but we have a new random variable the cross section area and we treat the load as a deterministic quantity. So, Y and A the yield strength and the cross-sectional area are random the load is not. So, let us take a minute to read the problem and then solve it Y and A are both log normally distributed. So, it makes sense to choose X 1 as log of Y and X 2 as log of A.

So, that we have a limit state that still is linear in the basic variable space. So, that is g X 1 + X 2 minus log of Q then we have to choose a transformation we continue with the second normal transformation as we did in the previous examples. So, u is x minus mu over the standard deviation. So, that gives us a linear limit state in the u space as before and we have done the computations for the mean and sigma of log Y and log A respectively.

So what you see on the screen is the final output of that it is a linear function in terms of u 1 and u 2 the only unknown constant is the mean of log A which is going to give us the log of A once we solve it. So, here is the solution beta which is a function of mu of log A has to equal 3 which is the problem statement. So, that gives us a mean of log A of 3.99 which gives a mean of a as 54 squared. So, it is in the same ballpark figure of mean of 50 that we had before 50 square inch.

So, now let us as we have been doing find the checking point values the most likely points and here something interesting happens the problem identifies both Y and A as strength type variables because clearly we see that the minimum this the checking point for both of them are in the lower end of the distribution. So, u 1 star is 2.5 standard deviations below the mean and u 2 star is 1.7 standard divisions below the mean that gives us the checking the checking point of design point values in the basic variable and physical variable space as 26 ksi and 46 square inch respectively.

Now obviously these numbers are different from what we had before because now the problem statement has changed Y is log normal A is log normal Q is not random at all. So, this was another example of a two random variable problem solved for the cable reliability example.