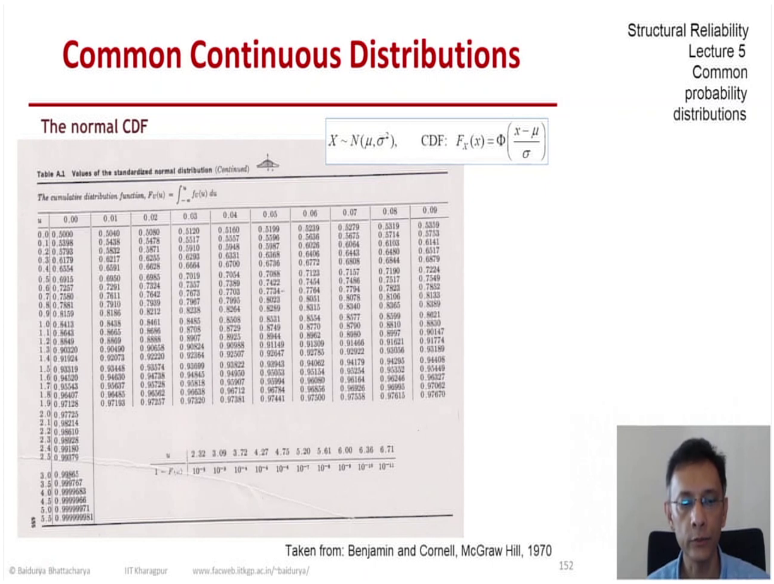
Structural Reliability
Prof. Baidurya Bhattacharya
Department of Civil Engineering
Indian Institute of Technology, Kharagpur

Lecture –46
Common Probability Distributions (Part - 17)

(Refer Slide Time: 00:27)

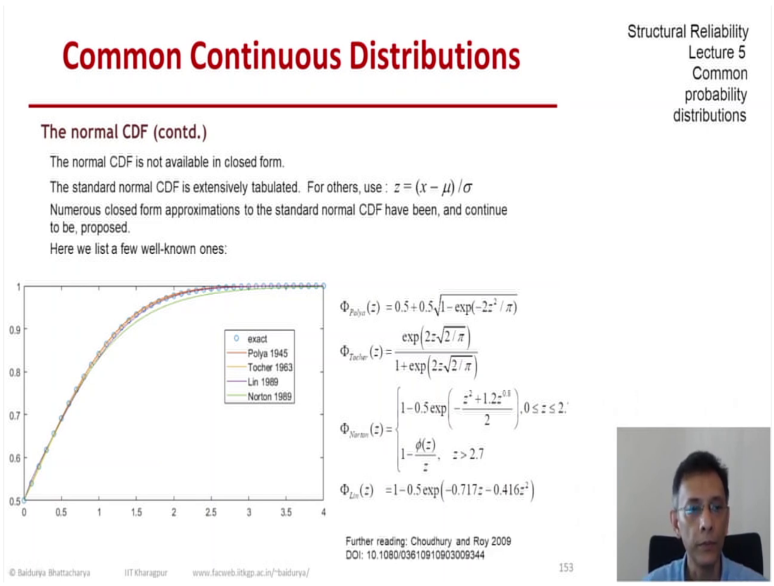


Now evaluating the normal CDF, so, as I said that we come back to the standard normal CDF which is extensively tabulated in all the textbooks and reference books. This particular page is from one of my favorite books by Benjamin and Cornell. So, let us just take a few seconds. For example if we want to find out the normal CDF at one and you will see that these tables because of trying to save paper they take advantage of the symmetry of the normal distribution and they start at zero and higher values of the standard normal variance z.

So, it starts with 0.5 as you can see. So, at z equals one or what Benjamin Cornell called here u the CDF is about 0.84. So if I wanted to find out the CDF of -1 the standard normal deviate of -1 I would subtract that from 1. So, it would be 1-0.84. So, roughly 0.16. I could also be interested in finding that particular value of the standard normal variant whose CDF is say 0.9. So, I would carefully look at the increasing values and see that somewhere around 1.2728 I am getting closer to the CDF of 0.9 and somewhere between 1.28 and 1.29.

I have the CDF of 0.9. So, the CDF of 0.1 would be the negative value of that. So, somewhere around negative 1.29 I would get the CDF of 0.1 and so, on and so, forth. In the next example we are going to look at the CDF of 0.95 or actually 0.05. So the deviate at which the CDF is 0.95 is roughly about 1.6. So, the CDF of 0.05 would be negative of that value. So, at phi of -1.645 or something we are going to get the CDF of 5%.

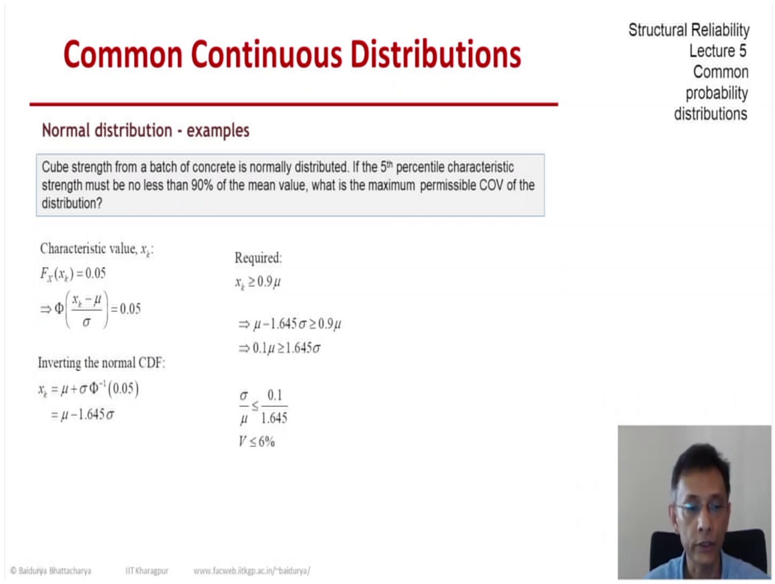
(Refer Slide Time: 03:26)



Since these normal distribution values are valid numerically there are many available approximations and some of them are well known some of them continue to be derived or proposed. And here I have listed some of the well known ones and as you can see these are also starting from zero and higher values of the standard normal deviate. And as you can see most of them are quite satisfactory.

And some of these can be you know used in a very convenient manner when you are trying to solve problems involving the normal distribution. Let us look at one simple example involving the normal random variable it involves cube strengths of concrete.

(Refer Slide Time: 04:22)



So, let us take a few seconds to read the problem. So, the characteristic value is defined here as the fifth percentile value. So, X k corresponds to the CDF of 0.05 and I could now write that in terms of the normal CDF making use of the mean and standard deviation of x and I could invert that as I we already found out in the previous slide that phi inverse of 0.05 is something like negative 1.645. So, X k the fifth percentile value in terms of mu and sigma is mu - 1.645 sigma.

Now the problem wants that that X k should not be anything less than 90 of mu so, let us proceed and see what we come to that gives me a relationship involving mu and sigma and since the coefficient of variation COV is sigma over mean this condition restricts sigma over mean or V to about 6%. So, clearly this requires a good amount of quality control to keep COV restricted to only 6%.