Structural Reliability
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Lecture –122
Component Reliability - Time Defined (Part - 01)

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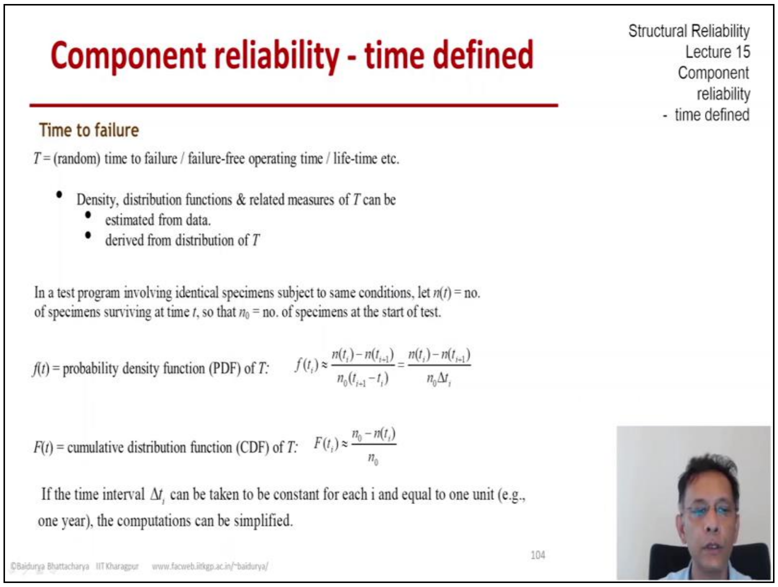

We now describe the time dependent reliability function of a component in terms of its random time to failure. So, capital T is this random variable and we can obtain data we can estimate the density function distribution function and other related measures from the data or if we have one function estimated we can describe others in terms of that. So, let us say there is a test program in which we start with n 0 specimens and zero identical specimens.

And then we observe as a function of time how many of them are surviving. So, n of t is the number of specimens that are surviving at time t. So, the density function of the random variable t can be derived approximately estimated from the data in terms of its definitions. So, we observe the number of items surviving at time t i and at t i + 1. So, the two adjacent instances and then use the difference between the two observations times and derive the density function as the ratio that you see on the screen.

We can get a similar estimate for the CDF the distribution function of t as the ratio of the number of failed elements at time t i over the original number of elements that we started the test with commonly if we could have delta ti to be constant. So, then some of these computations could be simplified.

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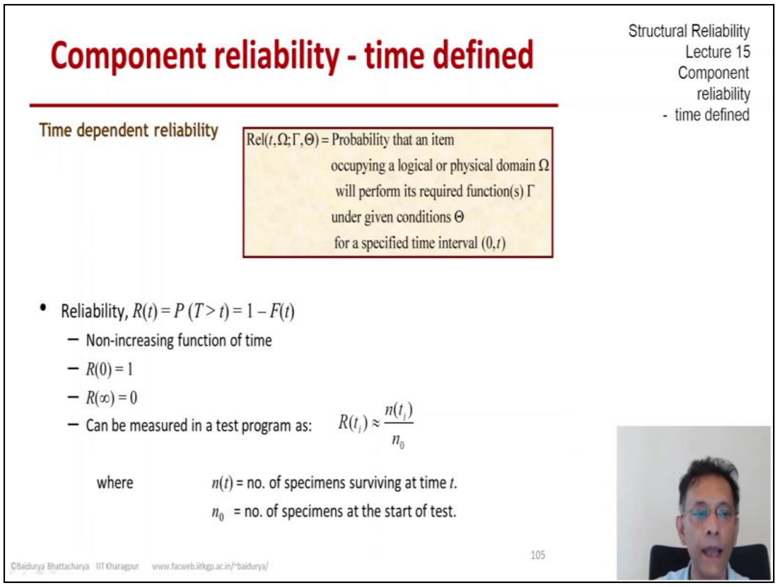

So, with this in mind let us now go back to the definition of reliability that we had at the beginning of this week that it is a probability that the item will do its job over the duration zero to t uh. So, we are looking at a component. So, the reference to omega is suppressed we have decided that we are observing failure. So, those performance functions gamma they are also suppressed as are the given conditions.

So, what we are left with is a very simple definition of reliability that the time to failure will be greater than the instant of time small t in question which is also nothing but the complement of the cumulative distribution function the CDF. So, going back to the properties of CDF F we can we can state that R reliability function is a non-increasing function of time it starts with one at time zero we are defining the time axis only for positive values and at infinity at very large times the reliability would fall to zero we can measure it in a test program as the ratio of the items that are surviving at the instant in question.

So, this way we could get R as a function of time discrete estimates of R from a test program and n of t is the number of specimens surviving and n 0 is the original number of specimens that we started with.