Structural Reliability
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Lecture –155
Capacity Demand Component Reliability (Part 03)

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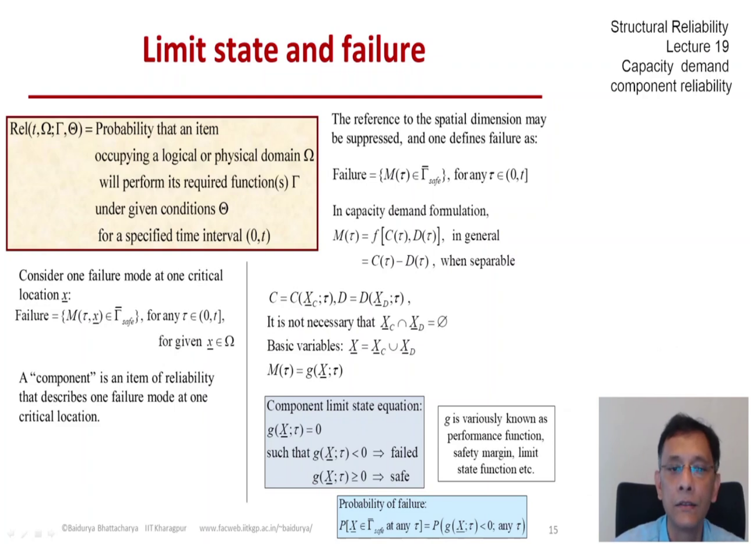

In the last few lectures we have come across the term limit state regularly. So, it is time that we introduced it and defines it formally. Let us start with the definition of reliability that we presented at the beginning of part B it was the probability that our item of interest performs its intended functions over the intended service life under specified service conditions and this item of interest occupies a logical or a physical domain.

So, if we consider one failure mode at one critical location x and when we say critical location it is not necessarily a physical location if i have a logical representation. So, it is one tag of one of these logical units. So failure is defined that in terms of safety margin or some performance margin exceeding the safe set comma safe or the acceptable set at any given time tau during the service life 0 to t for that particular tag or that particular location x.

So, when we talk about component in this context a component is an item of reliability that describes one failure mode at that one critical location or tag. So, if we are talking about components then we might as well suppress reference to x and define failure in terms of m exceeding the safe or acceptable set comma safe during any tau and in capacity demand formulation which is what we are interested in.

Now in this part of the course is this m is a function of the capacity and demand in some cases and it's intuitively very appealing to be able to describe the function as a difference as the difference between C and D the capacity and demand but in many cases it would be an implicit function. So, we may not have the luxury of this simplicity either way C is a function of a set of variables that define the mechanics of the problem D is a function of another set of variables x D that define the mechanics of the problem.

So, we are now going deeper into mechanics which comes from understanding of desired behavior what constitutes failure which we have already talked about. Now it is not necessary that there is no overlap between these two sets X C and X D in some cases the same variable might contribute to both and but again regardless the total union of these variables the entire set is the set of basic variables.

So, when we talk about Cauchy Riemann problems the safety margin is often given in terms of that symbol g and in term which is a function of the basic variables X. And the component limited equation then becomes g equals 0 such that g less than 0 implies failure and g greater than or equal to 0 implies safe performance. This g has various names this g is known as performance function safety margin limited function.

But in all cases it comes from the mechanics of the problem and our understanding of how the performance can be described in terms of the variables that define the mechanics of the problem. So, that in the end the probability of failure is given in terms of this g being negative at any tau between 0 to t.