Structural Reliability
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Lecture-226
Reliability Based Design Codes (Part-02)

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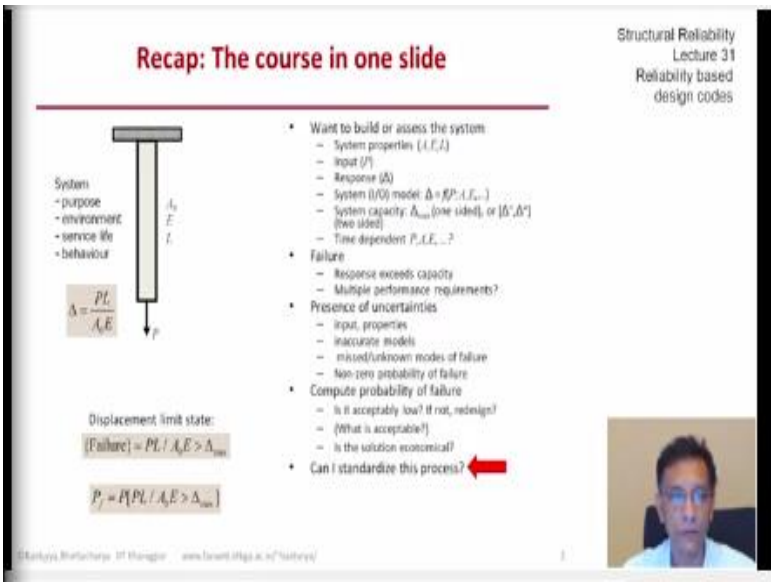

In the very first lecture I tried to present the whole course in 1 slide. So, actually now let us bring that slide back and in light of what we did in the previous 30 lectures, see if that single slide made sense or not. So, we had a very simple system which you see on the left part of your screen, the example being 1 prismatic bar in tension but it represents in general a system whose purpose, whose environment, whose service life and whose behaviour we know.

And what we want to do is we want to either build or assess the system. And as I said we know the system property, so for this particular bar we know the area, we know the stiffness, we know the length, we know the input to the system which here is just the axial force. We know what sort of response we are interested in and the equation that you see on the left is the elongation and we also have a model for that.

So, that represents in general the input output model, the finite element model whatever we may call that. So, it is a function of the inputs to the system and the properties of the system. And then

depending on what sort of response we are interested in, we must have an idea of what is the system capacity and what would be it is precise mathematical and numerical definition? We also asked the question that whether there would be time dependence in one or more of the system properties or the inputs.

And we actually looked at both kinds where we have looked at the loads being random; we have looked at the system properties changing with time due to corrosion, fatigue and so on. And then based on our knowledge of the system that you see in the first block, we defined or we are able to define failure response going out of a safe set exceeding capacity, the capacity could be one-sided, could be two-sided.

And then obviously we do not need to stay restricted to 1 performance requirement and we actually work through some examples where there were 2 or more performance requirements. So, we were also able to handle that. Now in all of these or some of these the system properties the loads even the model itself there could be uncertainties. And because of these uncertainties and things that we may not know about the system, there are non zero, there is a non zero probability of failure.

So, as soon as we acknowledge that we need to know what that is. We need to use whatever information we have knowledge of the system, the model all the random variables and random processes that are involved. And we should be able to compute the probability of failure which we did we discussed various approaches, techniques, approximations to do that. And then the question was that whether that failure probability is acceptably low and if not then we should be prepared to redesign.

And then we did not spend much time discussing whether the solution is economical or not? But that is one of the most common and ever present questions in all of engineering and all of human activities in general. We have still not discussed what is acceptable and I hope to cover that well in part D. So, we will have a discussion on target liabilities. And this last question can I standardize this process is the subject matter of this lecture and the following 2 lectures.

And it basically means that if I encounter a situation like this in the future a similar system under similar loads and similar expectations, do I have to start from scratch or can this process be standardized? In other words can there be a code? And this has obviously immense implications both in terms of efficiency and uniform safety.