Structural Reliability
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Lecture –220
Capacity Demand Systems Reliability (Part 11)

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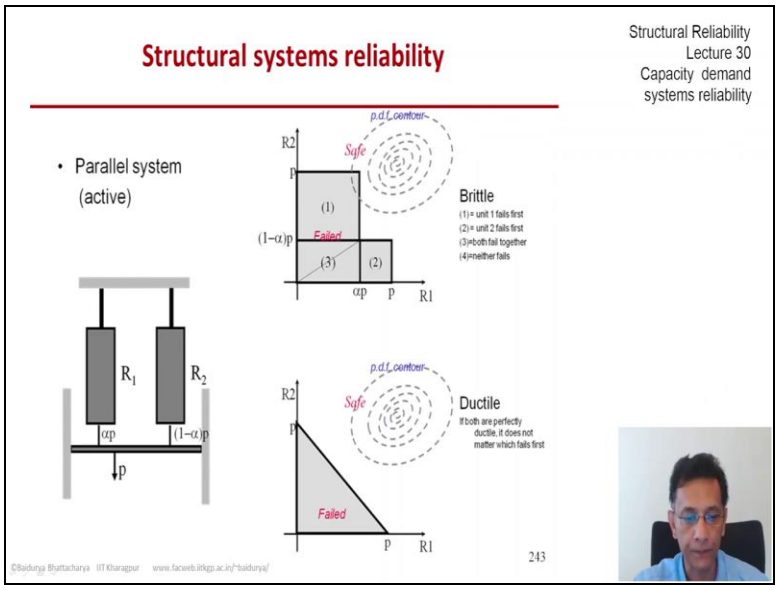

We start with perfectly brittle behaviour for the material uh making up the two members in the two unit active panel system loaded by the load P that you see on the left. This is what the failure region looks like. If you compare it with what we had in the series case, the failure region was much larger only the region greater than R 1 equals P and R 2 equals P was in the safe region everything else was failure.

Here because of the parallel arrangement of the two members, we have a much smaller failure region. And um, we did talk about what happens when one member fails, how does the surviving member behave. So, to continue with that line of thinking, I have split the failure region into three parts and these three parts actually are quite revealing. On the top the region marked as one is those cases where the unit one or the first member fails first followed by the second member failure.

So in that case R 1 is less than alpha P and because it is brittle after failure, it cannot take any load so all the load goes on to the second member and the it also fails if R 2 its strength is less than P, so that is the block marked one on the right hand figure. Likewise, we have the block marked two which is unit two fails first. uh And then the third block R 1 less than alpha P and R 2 less than one minus alpha P that is the case when both fail together.

So, ah, in some sense, there is no scope of redistribution of the loads, both of these members are weak enough so that they cannot take the load given to them in intact condition. So, this is what the perfectly brittle nature of the material would lead to in the R 1 active space for the failure region. uh If on the other end of the idealization, these two members were made of perfectly ductile material let us give that failure region for comparison, and subsequently, we are going to go through the details of these failure regions, how they came up and what consequence they have in terms of the failure probability.

So, this is what the failure region looks like in the perfectly ductile case. I have already mentioned here, and we are going to show it subsequently that uh for such a system uh made up of perfectly ductile material, it does not matter which element fails first. We are always going to end up with a failure region ah, which is given by that triangle in other words the line joining a P on the two axis is the region of failure contained by the two axis.

So R 1 + R 2 less than P would be the failure region in this case, but let us first, continue with the perfectly brittle situation.