Structural Reliability
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Lecture –151
System Reliability - Time Defined (Part - 07)

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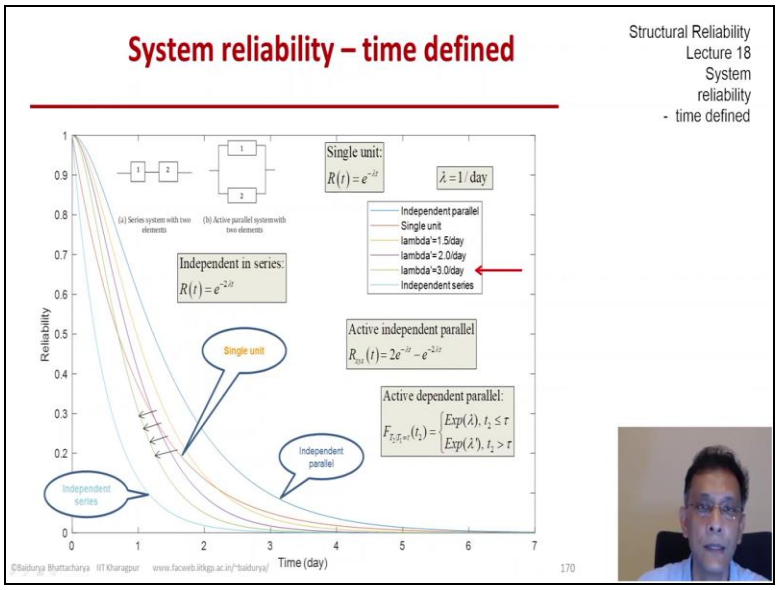

Now, let us go through an example where we could put all of these derivations together on the same platform. So, we are going to look at 2 unit systems 2 units in series 2 units in parallel where the units are independent and 2 units aware are they are dependent. So, that is what we just did. So let us approach this step by step. So, we have many curves here they are confusing. So, I am going to explain them one by one.

So, as I said these are the 2 things we are going to look at the on the left the series system and on the right the active parallel system and we will look at 2 cases when the 2 units are the 2 elements are independent and one where they are dependent with various strengths of dependence. In each case the base lambda is one per day and that's whether we have 2 units in series or whether we have 2 active parallels which are independent or the same lambda is there for the dependent parallel system where both are working.

So, that is our base lambda then there are six of these cases. So, let us go through them one by one. So, the first is and that's good to know it is the single unit. So, that is we have just one unit with rate lambda TTF exponentially distributed and that's that orange line is the curve which traces the reliability of that system at rate of one per day. So, the mean is one day now with that in mind let us see three of the ideal cases 2 of the ideal cases one is perfect series and the other is independent parallel.

So, the first is the independent parallel active configuration. So, that is that the top blue line and clearly the presence of the second element in parallel makes the system much more reliable and it is clear from the difference of the blue line from the orange line on the other extreme is the case of the independent series. So, that is what we see which is the lowest possible situation least reliable.

So, that is the third line. So, we are now going to stay within these 2 limits and somewhere in the middle is the single unit function. So, let us bring in the active dependent parallel that lambda and lambda prime that we just discussed and let us look at it with increasing strength of lambda. So, after the first failure the second one becomes stressed and that is that stressed nature increases with lambda prime.

So, the first case we will look at the lambda is 50 more lambda prime is 1.5 per day. So, that is the yellow line. So, the blue line the independent parallel now shifts downward to the yellow line and that is because the second unit becomes more stressed there is dependence with increasing dependence that yellow line moves to the violet line I would call that violet. So, that's when lambda prime is doubled.

So, that is twice per day and finally we have the green line and that is the case when lambda is lambda prime is 3 times. So, that is all on one graph we have 6 plots. So, in the middle there is that single unit on the top limit there is the independent parallel on the lower limit on the lowest limit there is the independent series and in the middle there are the dependent parallels and it becomes worse and worse as the dependence keeps increasing.