Structural Reliability
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Lecture –140
Component Reliability - Time Defined (Part - 19)

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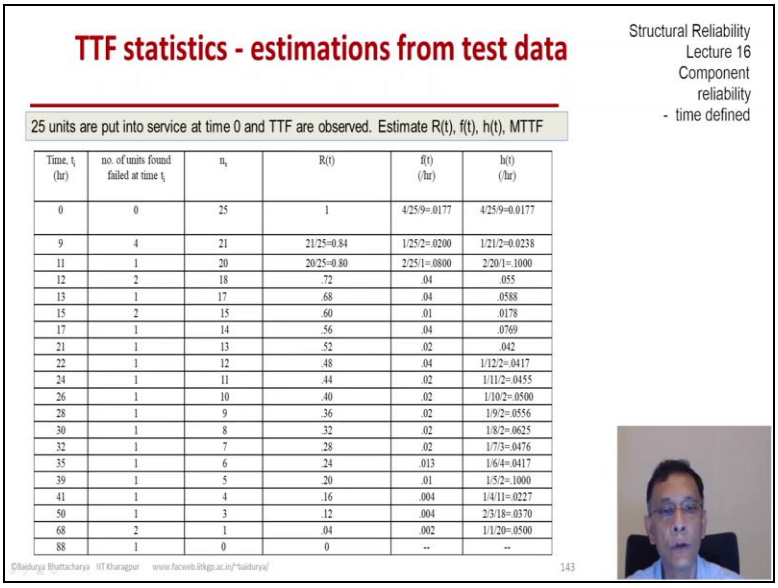

Time, t_i (hr)	no. of units found failed at time t_i	n_i	R(t)	f(t) (/hr)	h(t) (/hr)
0	0	25	1	4/25/9=.0177	4/25/9=0.0177
9	4	21	21/25=0.84	1/25/2=.0200	1/21/2=0.0238
11	1	20	20/25=0.80	2/25/1=.0800	2/20/1=.1000
12	2	18	.72	.04	.055
13	1	17	.68	.04	.0588
15	2	15	.60	.01	.0178
17	1	14	.56	.04	.0769
21	1	13	.52	.02	.042
22	1	12	.48	.04	1/12/2=.0417
24	1	11	.44	.02	1/11/2=.0455
26	1	10	.40	.02	1/10/2=.0500
28	1	9	.36	.02	1/9/2=.0556
30	1	8	.32	.02	1/8/2=.0625
32	1	7	.28	.02	1/7/3=.0476
35	1	6	.24	.013	1/6/4=.0417
39	1	5	.20	.01	1/5/2=.1000
41	1	4	.16	.004	1/4/11=.0227
50	1	3	.12	.004	2/3/18=.0370
68	2	1	.04	.002	1/1/20=.0500
88	1	0	0	--	--

This data set is taken from professor Nikon's book and as you see 25 samples have been tested but compared to what we had before these are not presented in intervals of time. And also the time to failure is not uniformly spaced and sometimes more than one failure has been observed. So, it is different in that sense from the earlier data that we analyzed from Schumann's book. So, this problem will actually be part of the homework set as well.

So, I would like you to compute the reliability function the density function of the time to failure and the hazard function and also estimate the mean time to failure uh. So, we have the formulas you can carefully fill up these all these cells in the table if you would like to do it yourself now please pause the video otherwise I will present the solutions. So, here it is. So, we have I have filled up.

So, the third column is the number of surviving elements all the way from time 0 hours to 88

hours and then the reliability function which is the ratio of the surviving the fraction of the surviving elements. So, that is straightforward and then the density function it is evaluated. So, two times are involved when we compute the differences. So, if you look carefully at the very first row under the density function the 4 is the number of units that have failed between time 0 and time 9 hours 25 is the n 0 the original number of samples and 9 is the length of the interval 9 hours.

So, that is how we continue all the way up to 68 because we cannot go beyond that and that is where the density function is 0.002 per hour in the last column we have the hazard function and again the first number there that 4 that 4 is the number of failures that happened in the interval 0 to 9 and then 25 is the number of elements that we started with that interval which is n0 in this particular interval and 9 is the length of the interval. So, that gives us 0.0177 per hour going down the second value of the hazard function corresponding to 9 hours.

So, that the first number one is the number of failures that happened the second number 21 is the number of surviving elements that we started with. So, that is n and t i and then the last number two is the duration of the interval which is two hours. So, that gives us 0.0238 per hour this way we can fill up all the all the cells and obtain an estimate of the hazard function what I have not done and you need to do for your homework problem is to estimate the mean time to failure from this data set.