Manufacturing System Technology - II
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Lecture – 06

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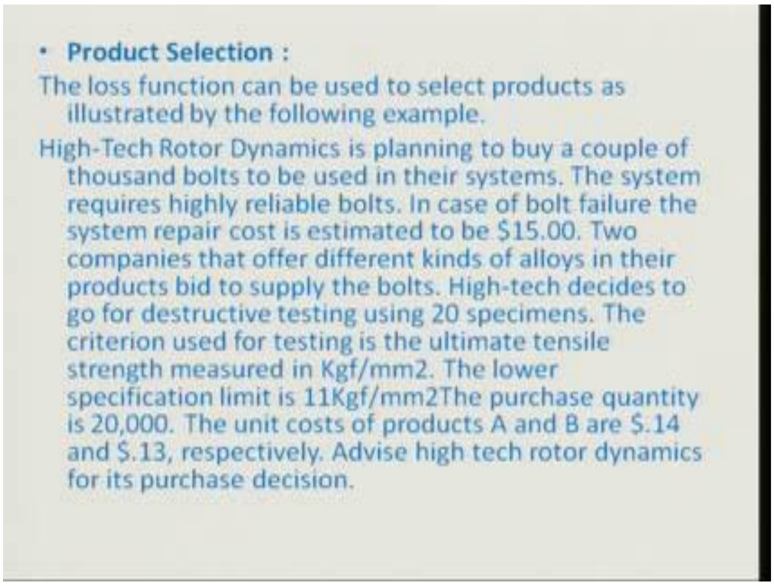

Hello and welcome to this manufacturing system technology part 2 module 6. We would talking about problem example where we wanted to make a selection decision between two different vendors from the company a rotor dynamics, and there was certain criterion which was used for a judging whether product A and B is better one of them was basically the ultimate tensile strength measured in kgf per millimeter square. There was lower limit of this particular force which was given that exceeding I mean lowing below which would be a criticality and not be acceptable in any case, because it is a ultimate tensile tends to be concluded that this could be case where will use the larger the better kind of the quality system to calculate the losses. So, let us us first look at you know the result from the destructive testing of 20 specimens that a rotor dynamic talks about between sample A and B.

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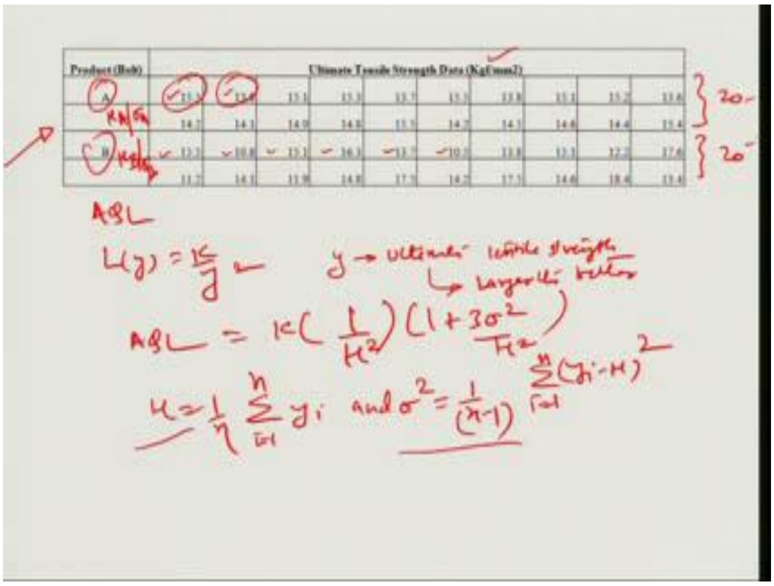

The table ((Refer Time: 0:16)) here can be seen is about both the product A and B where about 20 specimens happened tested a destructively for the bolts from suppliers A and B, and have been able to get a data of the ultimate tensile strength as represented here this 15.5 for example, in one case 13.8, in other case, so on so far. Similarly for B again you know these different entries are will make in this table which correspond to the different ultimate in size strength with refers to the sample number. So, the exactly 20 specimens of each type A and B, which have been destructively tested, and we will used the average quality loss for the loss functional y equal to k by y square in this particular case again retreating that y being the ultimate tensile strength goes for larger the better, because we already know that the quality loss AQL, average quality loss in this particular case would be represented by 1 by mu square k and of 1 plus thrice sigma square by mu square where mu again if recall was the process means.

So, we are talking about I wearing between 1 to n 1 by n y i and this square of sigma is represents as 1 by n minus 1 sigma I varying between 1 to n y i minus mu i square. So, the deviation of the quality correct, so having said that if I wanted to look at this particular table and see what is the process mean for A. So, let us that mu A, and what is the process mean for B, let mu B and similarly these standard deviation for A and B B, sigma A and sigma B. So, from a first principle using you know this different formulation given here, if we calculate from these 20 samples of each type.

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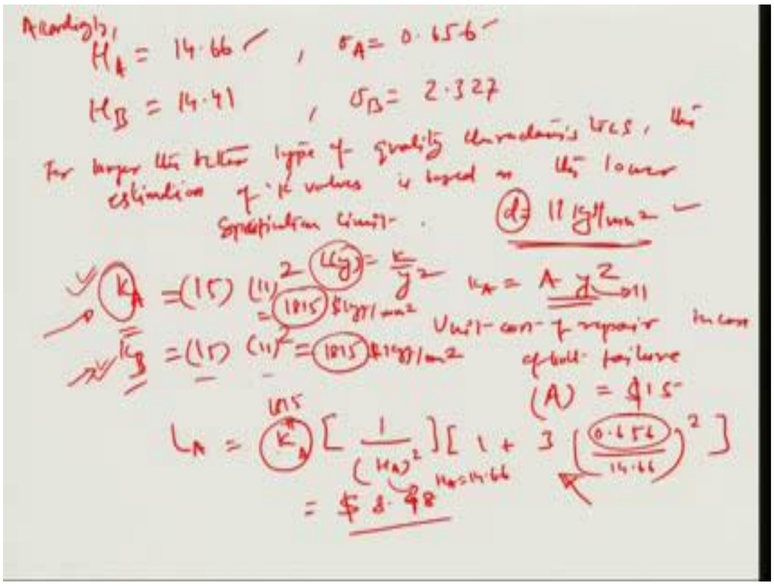

You get the process mean for A accordingly as 14.66 kg per milli meter square, and sigma A standard deviation of the distribution A as 0.656. And similarly process mu for B is 14.41 this particular case sigma B comes out to be 2.327 in this particular case. For larger the better type of quality characteristics, the estimation of k values is based on the lower specification limit, which in this particular case corresponds to the value d equal to 11 kg per milli meter square. So, this is minimum amount of ultimate tensile strength which is needed this particular case for quailing bolt to be expectable. So, therefore, the k A value here come out to be from the last function, you know in this particular case because last functional L y is k by y square. So, k A really equal to the unit cost A times of square of y, where y is 11. In this particular case you know y equal to d is 11 in this particular case.

So, here we can say the k value come out be equal to the last function, which is the unit cost of repair in case of bolt failure, and such an unit cost per system come out to be 15 dollar. If you look at the problem example the system require highly reliable bolts, in case of bolt failure the system repair cost is estimated to be 15 dollar. So, having said that we can actually tried calculate the loss constant for the product A and B, and this would be again the value for A the unit cost for the, you know system in the bolt failure happens and the square of the minimum specification.

So, 11 square and same is two for because you know similar kind of lower tolerance limit for both the cases A and B, you have the similar kind of k factors and both cases its comes out to be 1815 dollar kg per mm squares. So, you have to understand this is something that it can create a variable, it is supposing you have to vendor who was not very good in producing is certain minimum thresh holding of 11 kg force per milli meter square required for the company, you could always lower the, you could always higher you know d value for the particular vendor from 11 to let us say 13 or 14. So, that always is last constant would be higher.

So, that way it will give you a sort of buyers on that vendor that if you not able to tightly control, the ultimate a tensile strength property in automatically be fading the way, because you d value or the value that is needed for screening of the good from the bad bolts, its must higher in comparison to the other vendor. So, you can intentionally do that also sometimes to create a ripple in the system aluminates a few vendor, which you know a for sure don not produce quality, but then again you know depends on. So, obviously the intent has to be good in that particular case when you are doing force elimination of vendors A.

So, having said that now you can calculate the last function of both components A and B in this particular case loss function for example, A can be reported as k A value times of 1 divided by the process mean mu A square times of 1 plus thrice the sigma value for a which is 0.656 divided by the mu value 14.66 square, and this comes out of be equal to about close to 8.48 dollar if you calculate this. So, merely put the value of mu A to be equal to 14.66 put the value of sigma a to be equal to 0.656 as you have seen earlier in this calculation, and the k value of has been borrowed to be 1815 from the earlier step.

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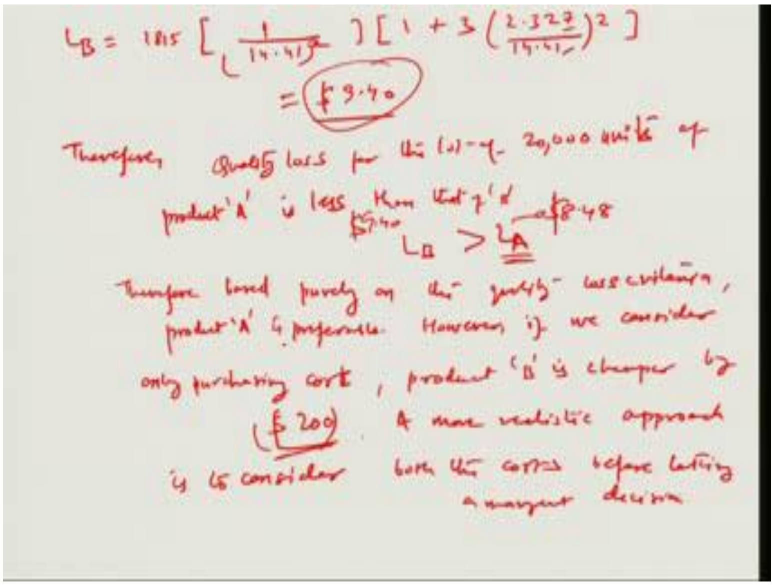

Similar kind of a you know analysis can be done for calculating the loss of point B here the value can be 1815 divided by 14.41 square, which is the new mean for the process B among the 20 observations of specimens perceptively tested earlier divided times of 1 plus 32.327 divided by 14.41 square, this is mu B by sigma B square this result showing like 9.40 dollars. Therefore, if I wanted to take management decision on the bases of quality laws, so quality laws for the lot of 20000 units of product A is obviously less than that of B. So, you can see here that L B here is higher than L A, L A earlier was 8.48 dollars, this is 9.40 dollars.

So, obviously first choice would be A, but you can consider again another factor A, it is very important that also there is a question of overall cost, that is coming here and you are talking about a 20000, a pieces of sample of a certain product. And if you look at earlier the cost of purchase of both the product A is actually a expensive product then B. So, obviously although the B your saying has a intentional laws or virtual laws which gets slatted on to the system A, and it is higher than a probably a dollar, then what A would otherwise doing in terms of losses, but you can see here that the overall unit cost of B is much lower in comparison at least one cent lower in comparison to that of A, and there about close to 20000 sense, which we were saving in a lot of 20000, you know or a batch of 20000 specimen of sample that you are getting for the system.

So, obviously the management decision then would look at both these aspects, and if purely the decision was on the bases of the loss factor then would definitely choose B, but then otherwise you know you are probably gaining about 200 dollars by getting the cheaper component whereas the loss the difference here between a and B is not more than let us say a one dollar and 40 cents. So, there is some times you know realistic approach which is used. So, in that in even probably you know that although the loss of higher B would still B, a better choice a in this particular case. So, I would just clearly write here that, therefore B is purely on a quality loss criteria product A is preferable. However, if we consider only purchasing cost product B is cheaper by 200 dollars, because of this 1 cent per piece deference between A, and B 20000 pieces being put on bolt for buying.

So, a more realistic approach is to consider both the costs a before taking a management decision. So, always see there would be a lot other factors which should be involved in this cases; for example, it may be that you know d time for B lower than A or for example, you know even if we talk about the overall quality laws there may not be more than 1 or 2 such events or for the whole 20000, there may be database which says that there are at least 5 pieces failing or 6 pieces failing, and there the decision would be based on whether 200 dollar higher or the number of timing that we are encoring laws, because of putting B into the system or A into the system is higher. So, come at sure at decision has to be made according to the data that is available in this particular circumstance.

So, we have kind of understood how the quality loss function can be a embedded into system although is a virtual laws, but it is very very important, and its governing criterion for sometimes making taking decisions on a managements scale for particularly related to the in-house talent design or purchase of component are even process settings, that can be may example like this from the industry were you can directly apply these quality laws this virtual laws phenomena to get an estimate of, you know you would otherwise sort of be able to choose one option would be other , because you know it is not giving you the kind of quality laws or it is not giving you the kind of full proof situation quality wise A, that comes out.

Having said that then a the question is that when we design the system, there has to be various factors to design system obviously there is going to be an engineering noise behind the system there is also going to be a you know a sort of the signal, which would give you the required quality characteristics to go up to the desired value or intended value there is also going to be a response based on the signal that you have to given to a particular system, and there responsible control factor which would guide the signal in a manner. So, that the response behaves in a certain aspect or certain way to the quality determinate to the quality characteristics determined which has been plant.

So, we will talk about these concepts in the next module where we will such engineering system in terms of noise factors, control factors, signal factors, and response factors. And then try to analyze is system performance based on all these different measurable or non measurable even quality it factors, it should be couple into this system.

Thank you very much.