Manufacturing System Technology - II

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Lecture – 04

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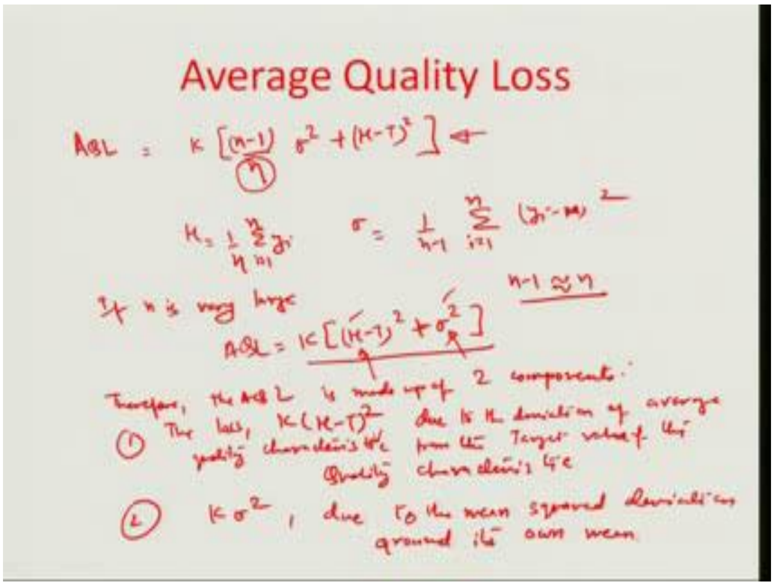

Hello and welcome to this manufacturing systems technology part 2 module 4. We will actually in the last lecture discussing the average quality loss AQL, which we ((Refer Time: 00:25)) out as k times of n minus 1 divided by n square of sigma plus mu minus T square. And we further defined the values of the mu and sigma by looking at the average of all the observations y i, i varying between 1 to n, and sigma to be 1 by n minus 1 sigma I varying between 1 to n y i minus mu square.

So, having said that what sentinel the AQL converts in to are what are the different conditions for the different sample sizes n, where this value would change significantly will how to probably to discuss. So, the first think that comes in mind is just if n is very large; that means, we talking about large sample size in this particular case, the average quality loss AQL would then be just defend by the mu minus T square plus square of sigma times of k, you know you can know all assume that n plus and n minus 1 is the approximately equal n is the equal to the quite latch.

So, in that situation the AQL will be made of two components. One of them of course, the loss k mu minus T whole square and this would probably be equal is due to the deviation of the average value of the y from the target value of y due to the deviation of average quality characteristics in this cases, you may remember that y is equality characteristics that we are visioning from the target value of the quality characteristics.

The second part of this particular loss which is related to the, I would see k sigma square value it would the mean square deviation y around so mean. So, this is due to the mean squared deviation around its own mean. So, that is how we can see classify the two different components; 1 contribution, because this replace how much the average value of the characteristics is reflected deviated from the target value, the other is basically the mean square error, that is pumped in to the system from the actual target from the actual quality characteristics to the main quality characteristics. So, the two components equally contribute to buildup, so called average quality loss.

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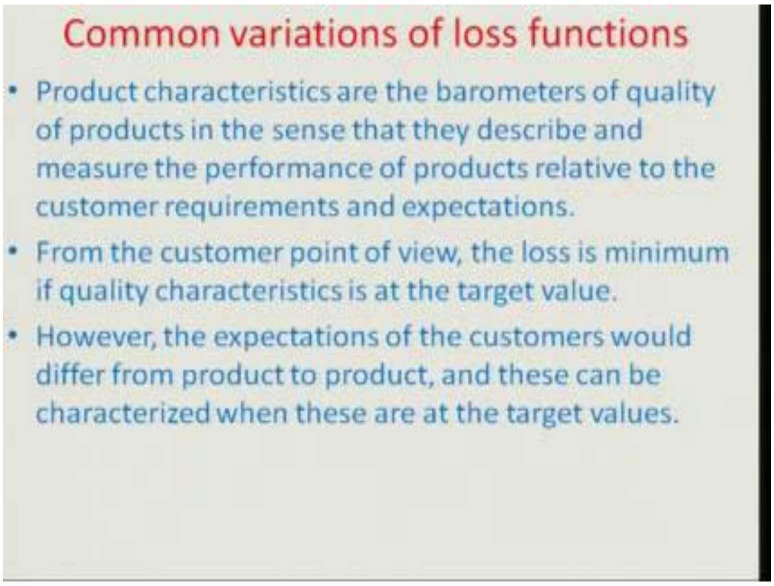

So, the common variations of the loss functions are quit essential for running a show in a particular business platform from a costumer point of the view of the of course, the loss of minimum if the quality characteristics is at the target value, but this is never happened because sometimes in order to do this you need infrastructure or you need sort of a you know change of process in a manner which is too expensive. The overall quality the product being high automatically mean the cost of the product would be expression quite expensive. So, and also again the factories that again the expectations of the customers they would be different from product to product, and this can be characterized when these are at most the target values. So, the advice how the customer perceives a certain product and a quality in the product also is quit variable. And you know depending on the what is the characteristics again what we are measuring, there is go to the variations in the strategy which you are formulating do calculate the average quality loss

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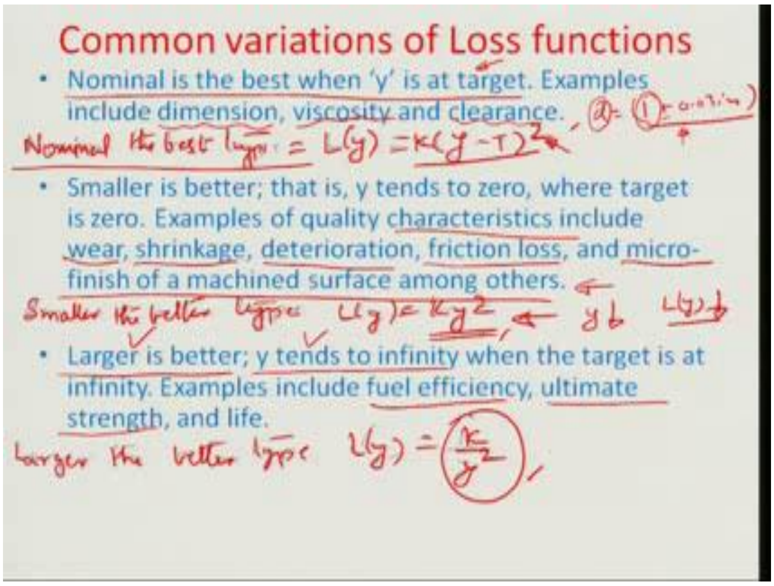

So, let say for example, there are some characteristics where you know y is at target nominally away from the target it may be reasonably, for examples let see taking about dimension of a particular shaft, you have a certain diameters d equal to 1 plus minus 0.03 inches characteristics perfection of a shaft diameters. And when you are taking about the quality characteristic which is the measurements of the diameters d; obviously, if it is close to these specification rays the better it is, and this is the way from the mean value T, that is 1 value the verse it is. So, we call this kind of a quality loss the nominal the best type, so here essentially we would taking about the loss function represented as k y minus T square to be minimal stick, because that what the target of the process would be that the accuracy will process should be around the mean of the particular specification of the parameters which as being given some example could be viscosity for example, clearance, you know these are going to be around the target value is better it is.

However, this is not the case when the quality characteristics changes from these numerical values like dimensions viscosity clearness etcetera into something which is undesirable in this systems. For example, let say when we take about characteristics like wear of a particular, you know translation or maybe shrinkage, because of different temptresses stresses, which are strains and stresses which are buildup in the systems or maybe to deterioration particular engineer systems or frictional loss associated with any engineer system or maybe we are taking about micro finish of a machined surface among others. So, here the smaller the quantity the better it is.

So, it is not really that whether you are sticking to that target value which has been given; obviously, it will be costlier to go below the target value, but these are characteristics where you better not want this characteristic in this system engineering system that you have planned. So, such kind of losses can be classified as smaller the better type. So, here smaller the better type really means that the last function where we just simply represent this by k y square and say that if y is going to go down and meaning there by the loss is going to go down, it is going to be better and better for the system. So, you cannot really have it target value in such an operation; obviously, the engineering logic behind the target here would be the if at all there was a target, it was because that if you wanted to go lower than that particular target value for the wear rate or for the you know shrinkage it would be adding cost to the overall system. So, it would be of between the cost that you are adding, and the achievement of less than target values.

But obviously, the desirability of any customer would be to eliminate these unnecessarily components from the system, and there should be minimalist, so that is another perception of the average quality loss. There are certain other parameters, which is on the other end of the spectrum where for example, we talk about fuel efficiency of an engine or may be ultimate strength or ultimate yield strength of a material. So, here obviously, the target would be the bigger the better. So, supposing there is fuel efficient engine which is over reporting efficiency, it is always going good from the prose prospective of the customer or the user.

For example, if supposing there is a shaft which bears more load than what it is what the target values are set to be it is always going to be good for the system, because then the breakdowns and the failures would be avoided because of that. So, such kind of systems would tend to have a infinite value of y, and we call larger the better kind of systems where we talk about the quality loses k by y square. So, it is just 1 by y square meaning there by y is smaller, the better and the y larger the better and better it is for the system in loss minimizes because of that.

So, let us look at what the average quality loss and all this different functional representation come out to be; obviously, the AQL is going to be different, if you are talking about nominal the best type or smaller the better type or larger the better type of the quality characteristics.

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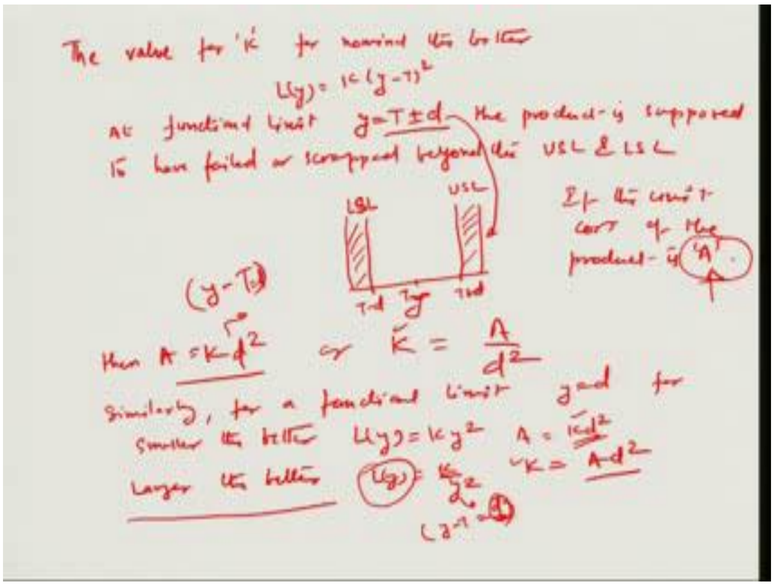

So, let us now try to algebraically compute what those values would be, the value for k for let see the nominal the better type. So, that is the cases 1 type that we would discuss in the last slide that is given by the loss functional y equals k times of y minus T whole square. So, at functional limit y equal to let see what about target value is there plus minus the d value the tolerance, the product suppose to have failed or scraped.

Obviously, because when we are talking about a let see a, you know target value of the quality parameters y at target T. So, the T plus minus d would really show the U S L in the L S L of these particular you know situation, here this is the minus T, this is T plus T. So obviously, any were outside this domain would be rejection or a scrap or a failure. So, so would have failed of scrap beyond the U S L and L S L and as suggested and below, you know which comes from these expression y equal to T plus minus d.

So, let us see the unit cost of the product that is in question here is A, then A obviously, is equal to k d square, where d is difference between the actual quality characteristics and the target value. So, that is k d square, because obviously if it is beyond d or its let say d are more than d then everything is the cost to the company. So, basically we are losing the unit cost of the product, because the product acceptable to be carat forward. So, therefore this is the basic of the calculation for k here. So, k obviously, become a by d square, and these kind of the situation.

And similarly for a functional limit y equal to d for smaller the better. We know that l y in this particular cases nothing but, k y square and so obviously in the same manner a value can be calculators k d square in this particular cases or in particularly larger the better cases, there would be difference the l y in the case k by y square. So, loss constant can actually we represent as a d square, because obviously will y is are the target d are y minus T is equal to d assume, so before its going to be taken as the complete loss to the company. So, there are many way of calculating the on the k value from the different relationship which are available here and both the nominal the better or the smaller the better cases which as reported as the unit cost, and otherwise would loss, because of non acceptability of the product by square d, whereas in the case larger the better k can be actually, we go to the cost time of square of d respectably.

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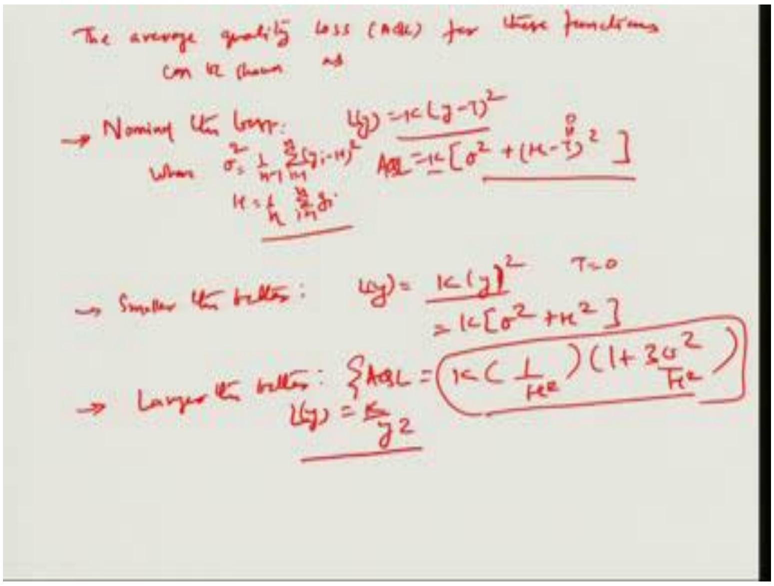

So, having said that the average quality loss them, I mean you know you that also needs way it I mean it will very because of the different nature of the loss functional. So, let us look at how the average quality loss where is the most is the cases. So, the average quality loss AQL for the functions can be shown as let say for case 1 nominal the best. You already known that the last functions l, y is equal to k times of y minus d square. And we calculated; obviously, the loss to be equal to k times of square of sigma plus mu minus d square, where sigma again was equal to 1 by n minus 1 square of sigma equal to 1 by n minus 1 sigma varying between i and n, y i minus mu square and the mu was calculated to be 1 by n, i varying between 1 and n and y i.

Similarly for the smaller the better case, you know that the loss functional l y is really converted in to k y square. So, there is no separate target value the target; obviously, 9 for these kinds of the perimeters, we already investigate the case of where for example, affection etcetera. So, in this event; obviously, if T is 9 the loss function, you know the l q l function as being earlier calculated in this particular case as k times of sigma square plus mu minus T whole square, this would only be converted into T equal to 9 case, as k times of square of sigma plus square of mu. And for the k is larger the better the L y obviously then would be equal to k times of 1 by mu square times of 1 plus of 3 sigma square by mu square. And there is the proof which exit, which I am really not going into at this time for how to calculate the AQL corresponding to the L y equal to k by y square. So, we would kind of we are to us the end of the this particular module, but in the next module I would like actually illustrate how this more on how this loss function the average quality loss which is actually a virtual loss is needed for taking the management decision related to the production on the quality in augmentation of certain system. So, that will just keep this for the next module.

Thank you.