Manufacturing Systems Technology

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Module - 03

Lecture -18

Hello and welcome to this manufacturing systems technology module 18. In the last module talked about the difference stages of process capability other the process planning with a stage one for a analysis of part government, then obviously stage two for the section the raw work for manufacturing operations in the sequences. And then we talking about machine to selection, and in that respectively also mention about that whether the process capability of machine can somehow being incorporated for doing the selections of the machine.

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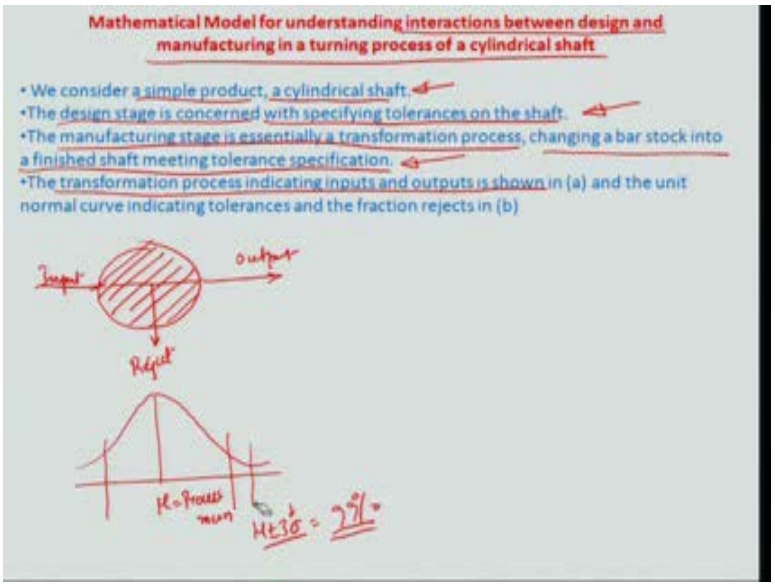

So, let us look at the problem example here where we talk about a small mathematical model for understanding interaction between the design, and the manufacturing process in a turning of operation of a cylindrical shaft. So, here we consider simple product this is study where there is a cylindrical shaft, and the design stage that is concerned is specifying tolerances on the shaft; obviously, the manufacturing stages essentially a

transformation process changing a bar stock into the finished shaft meeting the tolerances specification on the design the transformation process indicating inputs outputs are kind of shown here. So, let say this is the process, and there is a input to the process which can be inform of a ruff bar or a stock or a something of a certain ((Refer Time: 01:38)).

There is obviously, a transformation throughout this process, where it makes the output on the other side and in the process of doing that it also rejects some material in this particular zone, some other material which is to be process is not really meeting specifications and gets rejected. So, the question is whether you know the machine that we are choosing of the machine that we would really try to is thing for the try to select would have the right process capability. So, that minimum rejects are possible, that is the whole idea right, so obviously, few look at the process capability analysis, let say any process is basically distribute at defined by so called normal distribution.

So, let say any machining process there is a certain normal distribution the represented by the bell shape at curves way are it talks about process mean; obviously, the machine would have a mean value mean this is the process mean, and then there is also called process send a deviation which has as we probably all know, that if you go to nu plus minus three sigma it covers more and less about 99 percent of the parts of the whole distribution.

So, the question is again what is sigma what is the spread of the process, what is the variability of the output of the machine in that is what is meant by process capability? So, in this particular case, let us say there is there is situation where we have a tolerance value given by the drawing which just illuminate this nu plus minus 3 sigma, because that is as I told you are describe earlier, it is a process capability issue.

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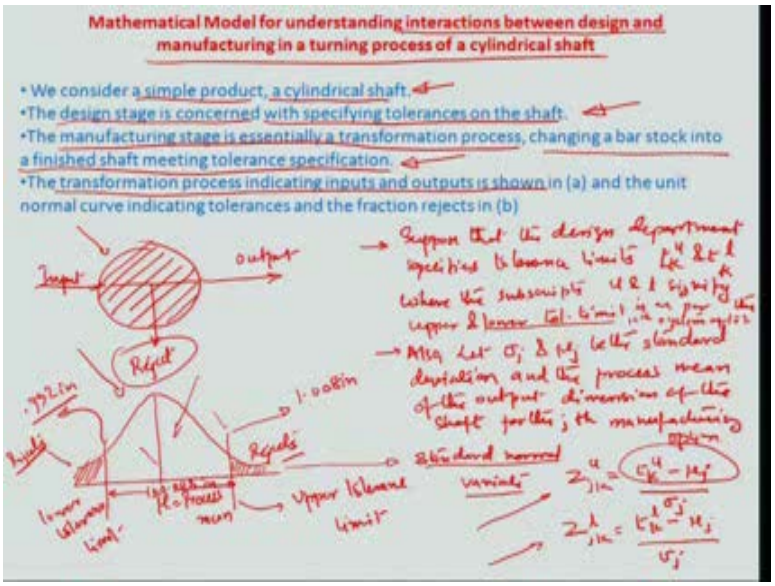

So, here let us a tolerance values which come by the design have a upper tolerance limit and a lower tolerance limit, we have a red designing figure out the shaft is about one inches in diameter, and the tolerance value the loved is a by the design is a plus minus 0.008 inches; obviously, the upper limit then would 1.008 inches, and the lower limit would be something like 0.992 inches, and that is how the shaft should that is have the shaft should be accepted or rejected. So, anywhere below the upper the low a tolerance limit or above the upper tolerances limit are the rejects. So, you have this area which shows the rejects, because of the shaft note meeting the upper tolerances limit, and this is area which shows rejects, because of the shaft note meeting the low a tolerances limit.

So, having this kind of situation of the question is to this process can be actually match this capability and try to figure out what would be a good match. So, that the rejects it as less as possible. So, let us supports that the design department specifies tolerance limits t k u and t k l, where this subscribes u and l signify the upper and lower tolerance limit also lets sigma j, and nu j be the standard deviation and the process mean of the output dimension of the shaft and that is for the j th manufacturing the operation or option. So, this tolerance limit is as per the k f system of tolerances in them the many systems of the tolerances which many to be incorporated while doing the designing. So, there for there has be a variability or there has to be a (( )) approaches saying that a particular tolerance of the cage type, you know is being matched according to the machine capability, where there is j th manufacturing option involve the k th particular tolerance on a design or the

design of the certain part.

So obviously, will now have to because there is a theory associated with normal distribution, and not getting in to because this is a something related to more statistical we have something called a standard normal variate. So, there will be a variate on the upper tolerances and lower tolerances, where your actually measuring the tolerances with respect to the process capability of the this particular process, and this is standard normal variate z for the j th manufacturing option in the k h system of the tolerances for the upper said comes out to the tolerance upper tolerance minus in the mean of the process divided by sigma j.

Similarly this standard normal variate for the j th manufacturing process for the k h system of tolerances system out to be t k l minus u j by sigma there. So, it is really about how many sigma j's are how many standard divination the tolerance on the upper said is away from the mean... So, how many times sigma a is covering that space between the t k u value somewhere here and the nu j value which is somewhere here. So, it is a sort of in impression which calls for weather it is a 99 percent or whether it is on 95 percent or 6 7 percent. So, if it is one sigma j than probably, it is somewhere wrong 6 7 percent, if it is 2 sigma j, it is about 95 percent, this comes from common statistics common mathematics process is of normal variations, and normal distributions and assume that where away of this normal distributions and have their handle.

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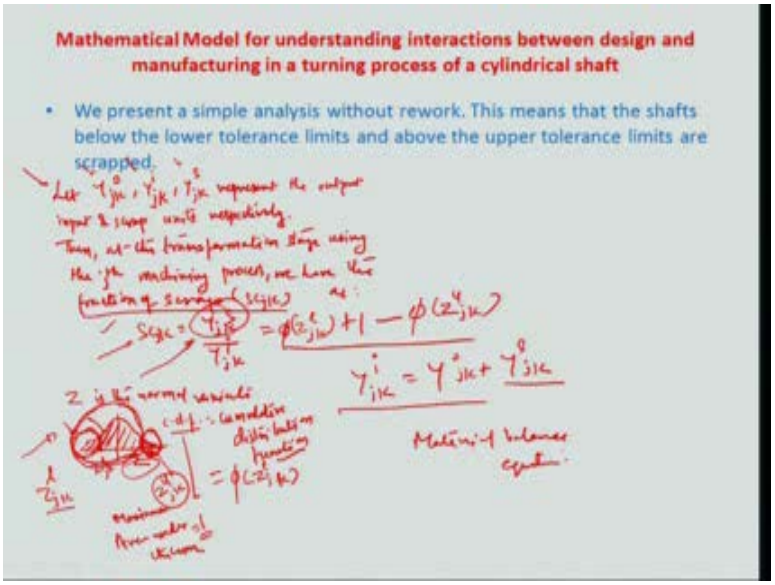

If you look at the material balance equations, we have to consider the input output and scrap units related to the process respectively everything should be interns of cost and then of the optimization of that cost. So, let y j k 0 y j k o y j k i and y j k s represent the output input and scrap units respectively. So, then at the transformation stage using the j th machining process we have the fraction of scrap s u j k as this scrap units per unit the input units, and I would just like to say or I just like to put its the form the normal distribution as show earlier. So, we wants of do a material balance equation and try to figure all interns of rejects the rejects higher; obviously, they output would be higher output would be lower in compression to the input in the material would be little bit this balance, you know flow will be this balance, because the rejects of this scraps and obviously, little bit costlier manufacturing in system by is a (( )).

So, here we want to just indicate what is this is scrap fraction that we are generating; that means, what is the scrap output interns of the as a as a percentage of the input material the disturbed in to the process, and then we come back to the so called normal distribution that we have done earlier. So, these z variate that we are showing here, a normal variates are essentially florid on the table, where there is a short of area under the curves of the particular, you know z variate in to question that is being generated from the normal function, and this area and the curve is five to well tabulated it is infected numerical integrated, which has to be ah calculated in input mentioned in the various values related to that the solution for the ah the normal distribution function.

So, the normal variate is plotted as bell shape at curve, and the area under the curve of these normal variate is also known as the cumulative distribution function fine, you know. So, just putting it this way that like say z is the normal variate and v flout the normal variate as normal distribution function and the area under the curve, here let say if I considered the area up to this particular point. So, the area would actually be represented by something called a c d f or cumulative distribution function, and this c d f is actually numerical integrate, which is calculated based on the this normal function right here interns of the z variate, you know and represents the area under the z curves. So, having insides that this also is known as the function five of the particular z variate in questions; there are two z variates here that we are evaluating one; obviously, z j k of the lower size. So, the normal distribution z j k of the lower size would nothing but, let say this is somewhere the low tolerances, and the z j k on the lower side would actually

being the total amount of material up to the z lower j k z l j k the area.

In fact, represented by the circle de zone on the normal distribution curved and the total amount of area at the upper side corresponding to this curves z u j k would be the whole area represented by this bigger circle all the way up to here. So obviously, fever to consider the scrap fraction. So, we can take this directly as this scrap anything, which is in this particular zone below the tolerances is rejected. So, we can say that this is five z j k l rejected fraction reject, and we also know that anything above this is zone is rejected and one more thing is that the maximum value of this is distribution function happens to be one. So, the area and the curve here maximum area end of the curve comes out to be one.

So, therefore we can say this part here right here, which is the fraction reject, you know being away from the upper value of z j k z j k is the particular value would actually b equal to this 1, the whole area 1 minus the shaded area represented by the big circle here which is if i of z u j k.

So, now is a case had a respective of the how many numbers of inputs outputs of scrap are being generated we can simple fit to this normal distribution function, which is actually unity in to this domain and create his scrap fraction here, which is represented terms of the number of scrap units per the number of inputs. So, having said that know. So, the transformation stage would invalid, you know of course the simple equations that all the input put either be generated as an output which a successful throughout the manufacturing process or a unsuccessful output which is a scrap.

So, this is the material balance equation, and then we would like evaluate it, and we will take it up next module how this material balance equation can be in terms of a cost to a in manufacturing system. And then we can also see the time as per, and then optimize is selection decision between that different based on weather of process is good capably produces rejects or not… So, that what is the over all output unit cost because of less or reject or more rejects in the coast would vary and reserved the time, and then we will try to try to take selections decision based on that. So, with this side like to close this particular module.

Thank you.