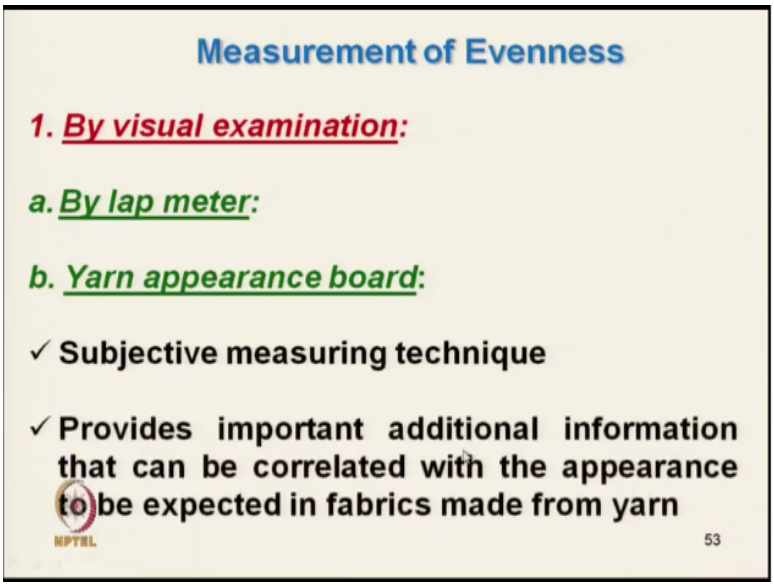
Evaluation of Textile Materials
Prof. Apurba Das
Department of Textile Technology
Indian Institute of Technology-Delhi

Lecture-34
Evaluation of Yarn Evenness (contd…)

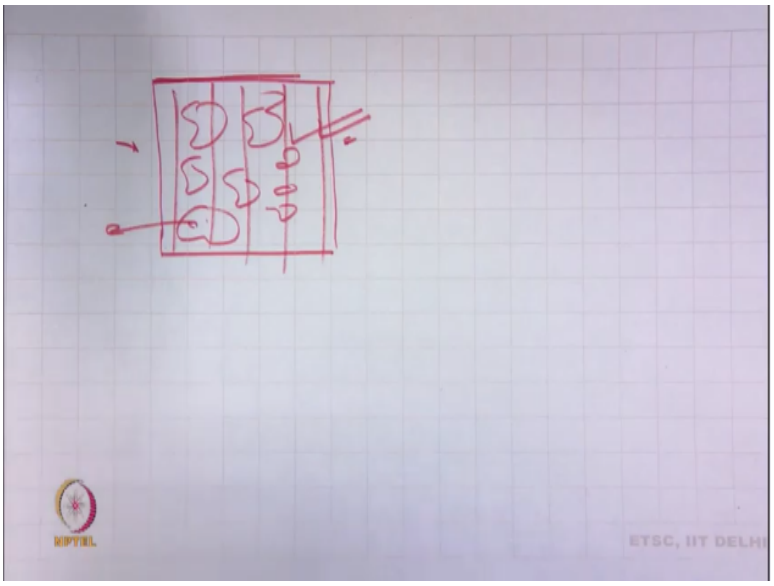
So, hello everyone, so we will continue with the topic evenness in textile material ok, so now we will discuss the measurement techniques measurement of evenness.

(Refer Slide Time: 00:37)



So, first method is that by visual examination, so if we can see properly if we can see the material visually, so subjectively we can say this material is even or this is uneven. So, that visually we can judge ok, so 1 is that lap meter, lap meter what is that.

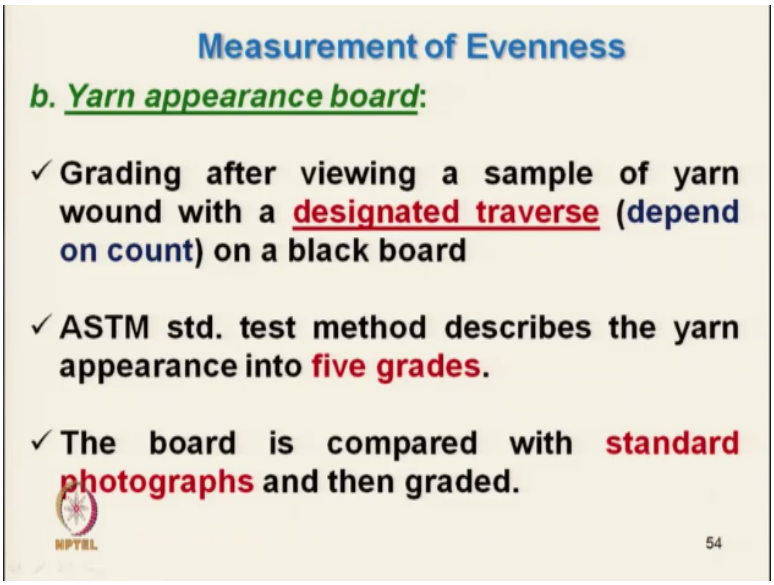
(Refer Slide Time: 01:09)



Here there will be 1 board which is from back side illuminated with light ok right, so illuminating board and over that we were placing our lap although laps are now a days not being used in the industry. But and here in case of any unevenness patchiness it can show because if we can control at that point, so that will give direct indication whether this is going to create problem on ok, so that is a lap meter is 1 technique of measurement of evenness of lap by visual technique.

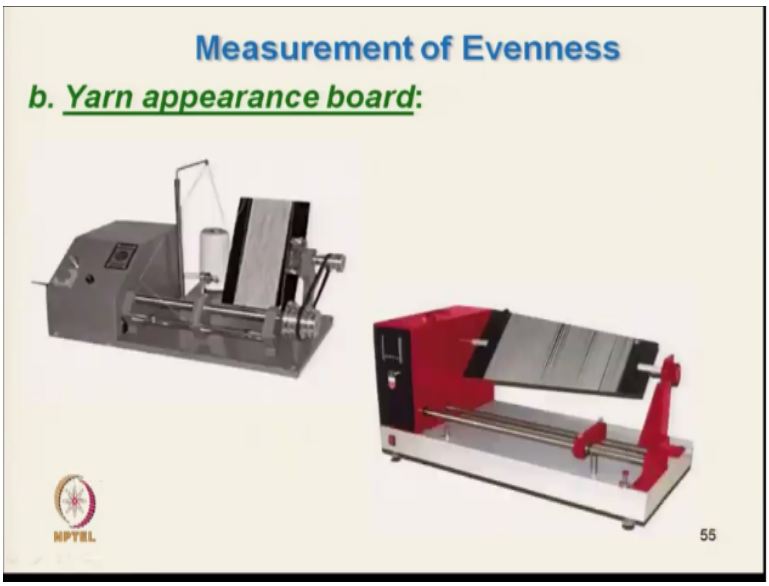
And another is if yarn appearance board, so yarn appearance board is very actually widely used in industry and this will give us very actually quick overall assessment of evenness of yarn, it is very simple technique. Subjective measuring technique provides important additional information that can be correlated with the appearance to the expected fabric made from a yarn, so looking at the appearance in the appearance board we can make out the what type of fabric it is going produce. So, that it is a very important and very quickly we can measure we can judge.

(Refer Slide Time: 03:01)



Grading after viewing the sample of yarn wound of the designated traverse, so the traversing will be there will be a blackboard on which the yarn is being own ok. So, for colored yarn normally we do not use blackboard in colored yarn it is a white board on the white board we just wind the yarn and depending on the count thickness of the traverse rate changes. So, that proper distance, proper separation of yarns are there and ASTM as per ASTM there are 5 different grades ok. And the board is compared with the standard photographs available and we can grade them ok.

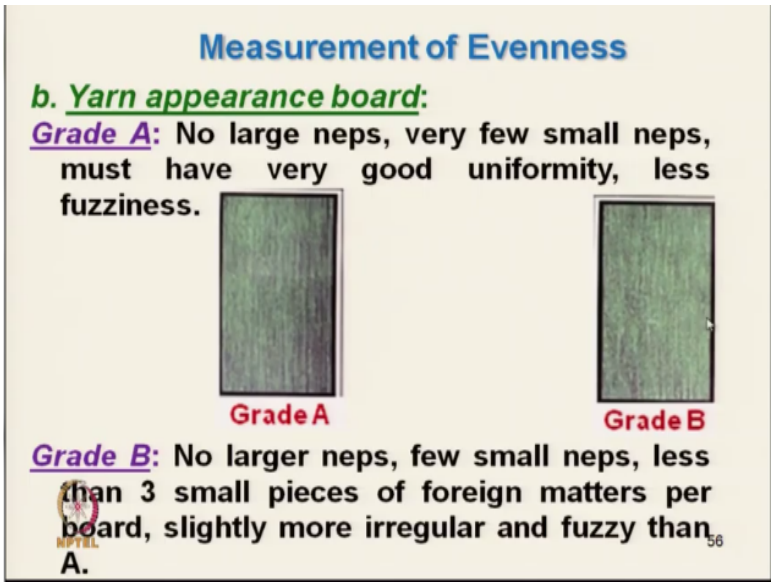
(Refer Slide Time: 03:52)



Now this is the typical yarn appearance board wind up this is board read of basically 2 types 1 is the rectangular, another is trapigenic. So, this I this way, so we can simply wind the yarn ok this

maybe automatic or maybe manual. So, that we can wind the yarn here and compare with the standard photograph ok available.

(Refer Slide Time: 04:25)

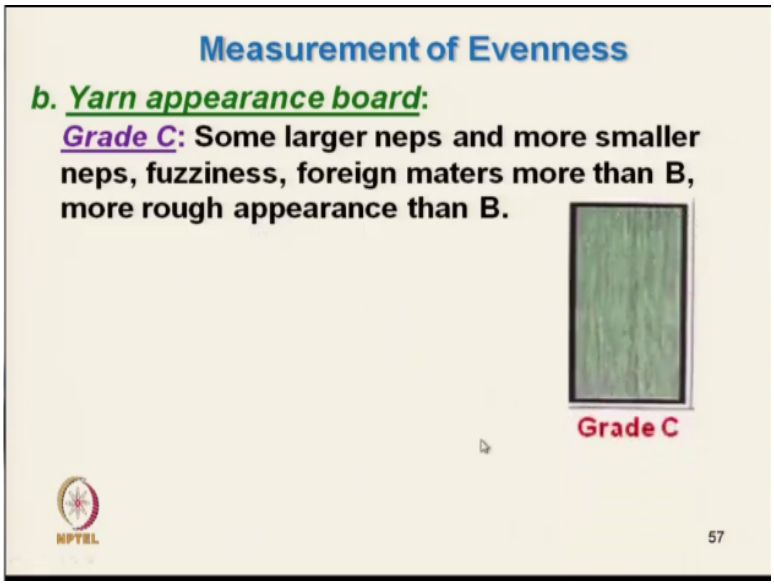


Now, so grad A means best quality portion ok that means depending it does not depend on the count ok, it is basically overall grading. So, in that case there is no large names very few small names ok, no large names because few why few small names because we are talking about the say this is basically for cotton yarn there will be some names short fibres will be there, there will be some neps.

So, we cannot have the grade without any neps, so there will be some neps must have very good uniformity and less fuzziness means hairiness is less ok and this is the grade, grade A. If it is the our present yarn is close to this, so that we have to judge subjectively ok. Similarly little bit inferior than grade A is no large names, few small names less than 3 small piece of foreign matters will be there if it is if at all it is there slightly more irregular.

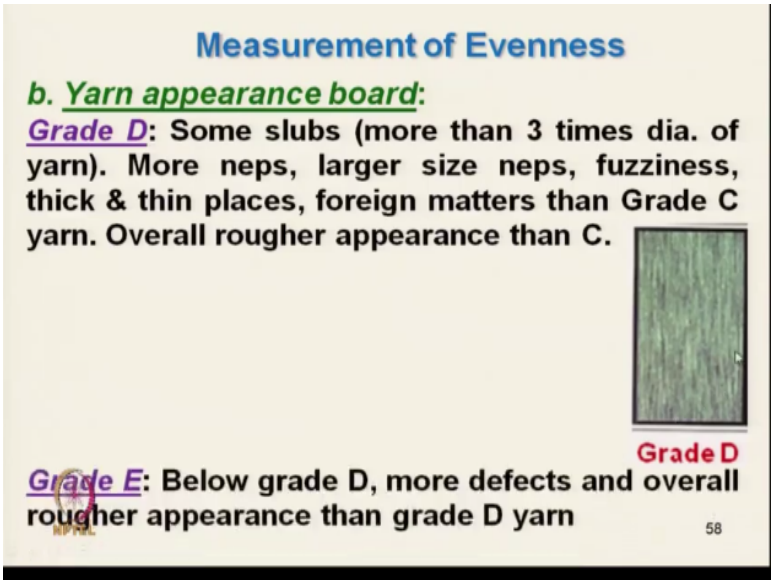
So, irregularity will be little bit more looking at the board 1 can make out and fuzzy, so it will be little bit hairy, so this is the grade B. So, if we can compare this we can and we have to place our board in actually beside this. so, we can compare which grade it is.

(Refer Slide Time: 06:09)



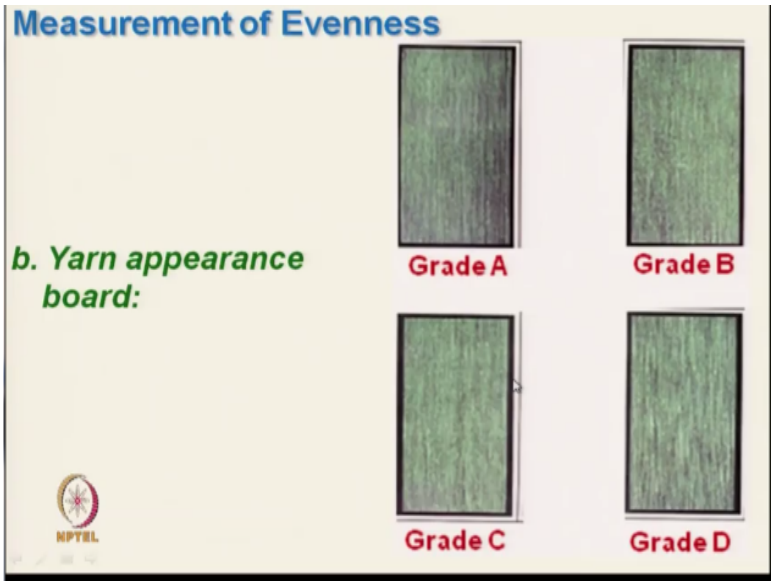
Similarly grade 3 will be little bit inferior, so larger quantity of so more neps will be there higher fuzziness or foreign matters will be there, this is the grade C.

(Refer Slide Time: 06:24)



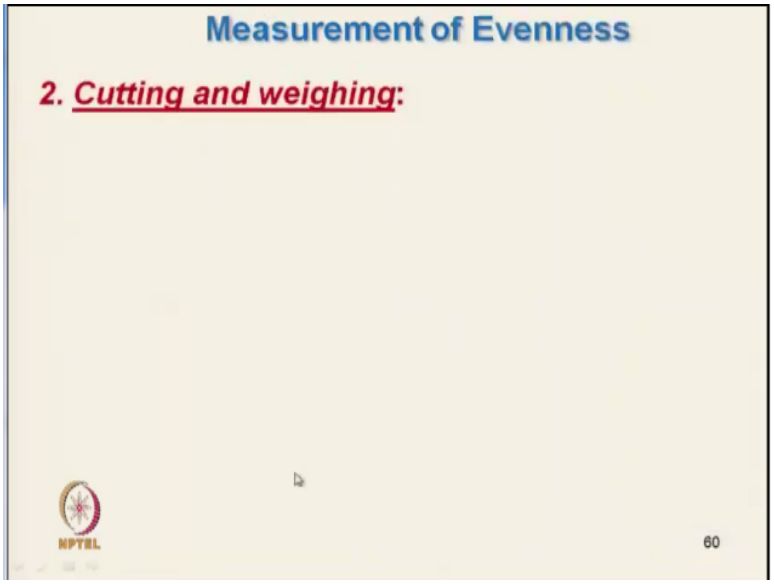
And grade D is further inferior quality, so in this way, so grade D is there and grade E below grade D. So, overall we can see we can compare we can place our board present here, so we an grade accordingly, so this will give us overall idea about the yarn quality.

(Refer Slide Time: 06:50)



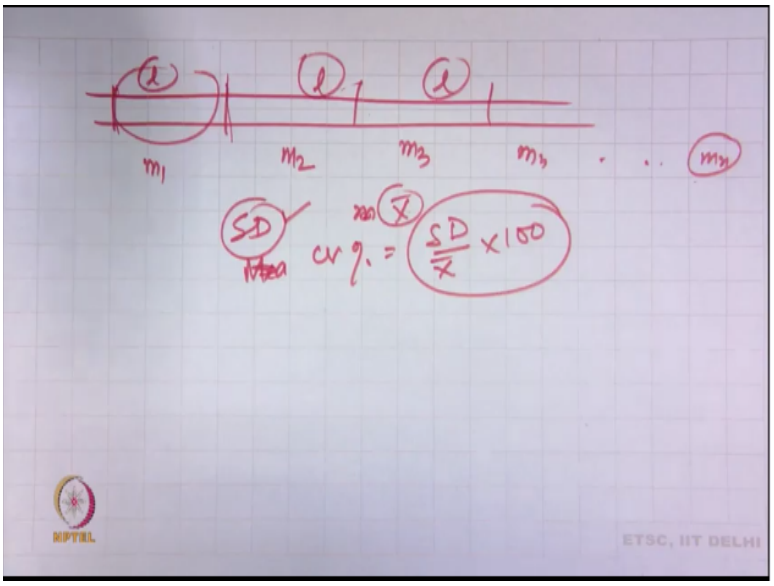
So, these are the different grade we can see this is the best quality and this is the low quality.

(Refer Slide Time: 06:58)



Next is that the cutting and weighing method this is very commonly used in industry, what we do.

(Refer Slide Time: 07:12)



We have a material yarn, sliver or roving and we cut the material ok with certain known length L, fixed length L. For yarn length is different for sliver length is different and for roving there will be different length and even if you want talk about the lap it is different ok. So, that you cut this material and then take mass m1, m2, m3, m4 like this. And we know the exact mass of the material of a certain length.

And then we take the standard deviation and then CV% mean we know standard deviation and then CV% we can calculate standard deviation/mean*100. So, this way we will we can calculate the CV% of mass/unit length why I am telling the mass/unit length repeatedly here it is important. Because we will see in other automatic instrument we talk about the mass/unit length variation without measuring the mass.

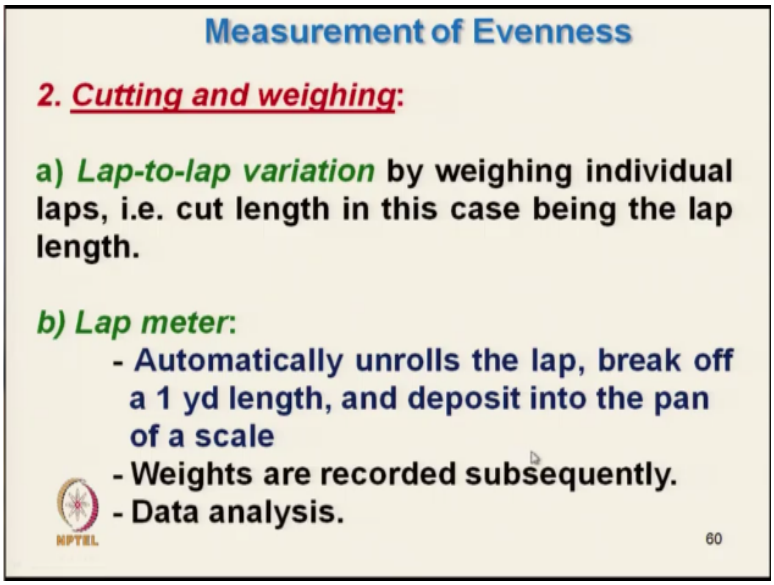
But here in cutting and weighing method we actually measure the mass if you ask me the what is the value of average mass. Then I should be able to tell, that this is the value of the average mass of the material x ok, that value is available. So, that is why cutting and weighing method gives the exact value exact reading but main problem of this technique is it is a very slow technique.

So, for day today measurement or for large quick measurement it is not possible and also cutting and weighing method another problem is that our length cut is should be sufficient. So, that we have certain mass. Suppose in this yarn if we want to take want to measure the mass variation of

say per centimeter, 1 centimeter every 1 centimeter length and we want to measure the CV% then it will be very difficult.

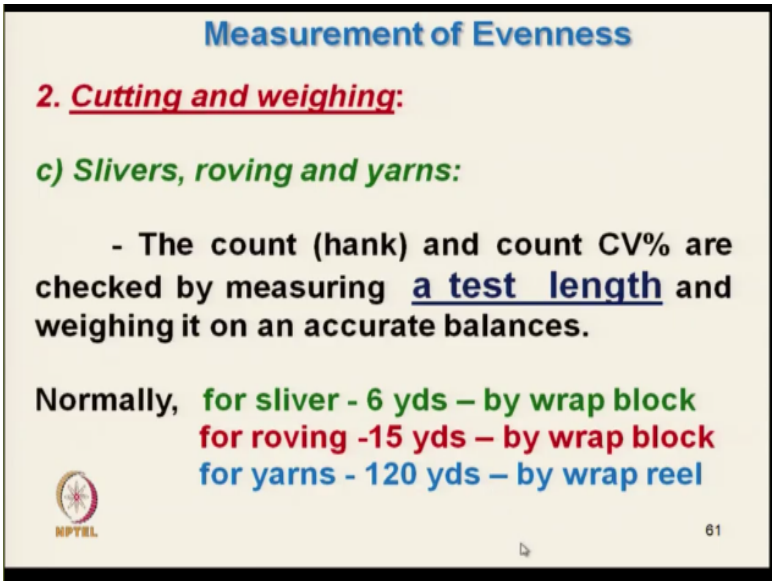
First thing is that we have to cut a large quantity of large number of pieces then we have to take bars, we have to take calculate mean standard deviation, CV%. Then so it is not possible and if we want to have quick large number of sample then it is impossible. So, cutting and weighing method is only possible when we have the smaller sample, we have time to measure that in those case we can measure this.

(Refer Slide Time: 10:40)



So, lap to lap variation, so what we take the mass of lap and then measure the take the whole lap and then measure the mean and CV% that is a lap to lap variation and lap meter is there where automatically 1 yard length is cut. And then measured the mass of that 1 meter and we can measure the CV% standard deviation, the words are recorded subsequently and data analysis is there.

(Refer Slide Time: 11:20)

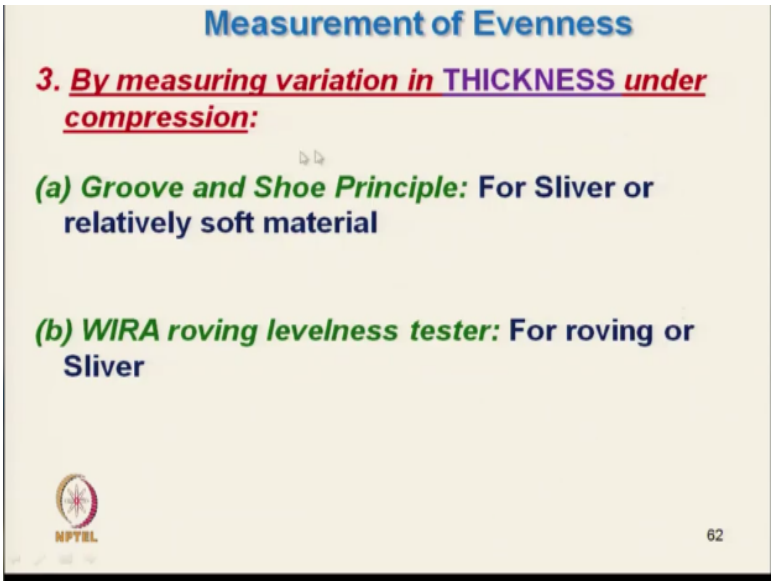


Now for sliver, roving and yarn still it is being used because we need to know the exact value because we need to calculate the count or linear density. Because we not only serves the unevenness measurement, evenness measurement it also measure we by that we can measure the actual linear density of the material that is why here the count or hank and CV% are checked, so here CV% along with the count or count along with the CV% this measured by measuring a test length and then weighing it accurate by measuring values ok.

So, for slivers it is the length specified is 6 yard length we can take more than 6 years but then in that case it cannot be compared see if we want to compare the CV% of 1 material to another material. So, in that case we have to keep the length fixed otherwise if we increase length then the another type of problem will crop up that I will discuss which is called Vl and Vl between length variation and within length variation, that I will discuss in detail.

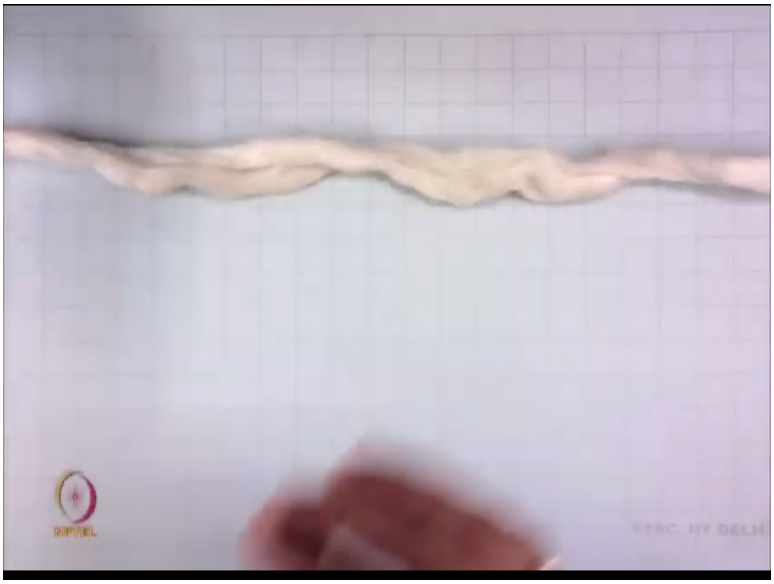
So, that is why we need to compare the uniformity irregularity at for a particular specified length. So, for sliver 6 yard is the standard length, so and we wrap we actually measure this length by wrap block and for roving it is a 15 standard again we use the same wrap block and for yarn it is 120 yards we use wrap reel. That we have discussed already when we discussed in the yarn count measurement.

(Refer Slide Time: 13:26)



Next technique is by measuring the variation in thickness ok, so this material suppose this is sliver.

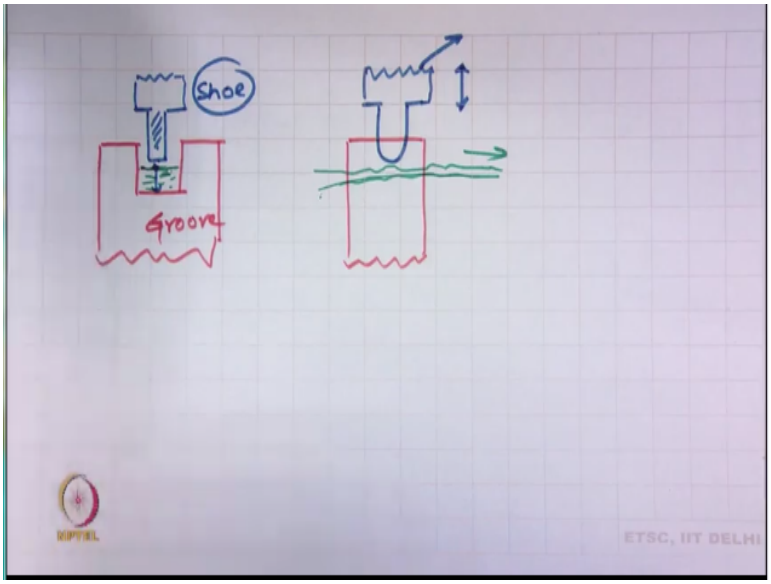
(Refer Slide Time: 13:44)



Here this sliver thickness that if we measure the thickness of the sliver at different portion that will give the idea indirect idea of mass variation. There are various techniques of measuring the thickness variation by measuring thickness variation we can measure the irregularity of material. So, one of them is that it is called groove and shoe principle this is actually used for sliver or relatively soft material where number of fibres in the cross section is large.

Because it cannot it is not possible to measure like roving or thinner material here the sensitivity of the instrument is not that fine. So, that larger variation it can measure, so is the principle is I will just draw.

(Refer Slide Time: 14:57)

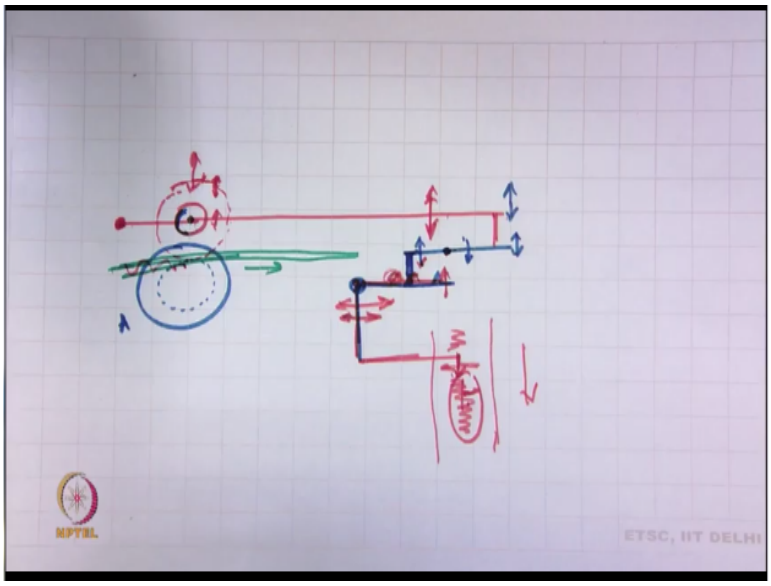


Here ok this is a grove here in the grove we have we are process passing the sliver material ok. Now I will draw with other color, so this is material and this one is grove ok and now what we are placing, we are pacing 1 shoe that is why it is called grove and shoe principle. Here this is providing some mass weight and this distance this is the thickness we are measuring the thickness ok.

And if I draw the side view of this ok this is the control now here it is a this shoe is ok now and the material which is moving. As this material is moving this shoe will have this type of motion which is actually measuring the thickness upward motion ok. This type of and this indirectly this we can record if we can record this movement we will actually it is giving the unevenness of material ok, this is 1 principle, this principle is known as the grove and shoe principle.

Now another technique is here this technique is known as the WIRA roving levelness tester. Now this is used for either roving or sliver, soft material the principle wise it is almost similar to the this other technique with the grove and shoe principle. But here the recording is better ok, now in this WIRA roving levelness tester the principle wise I can just draw.

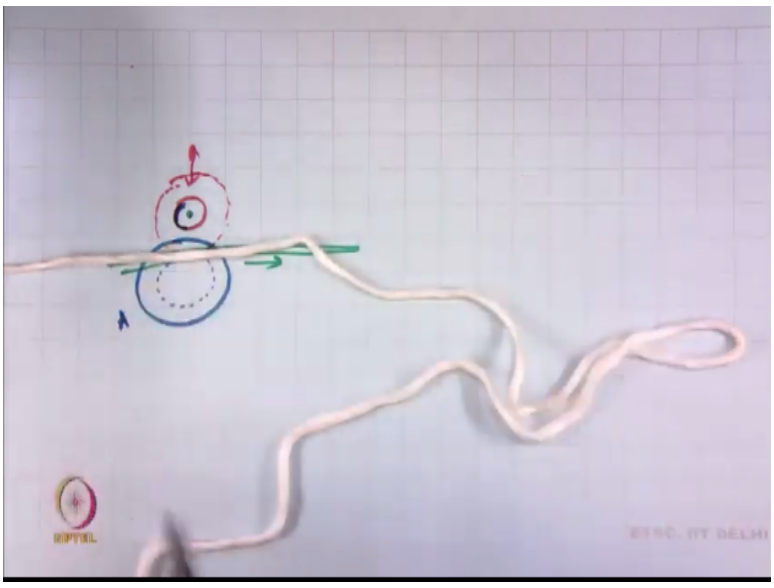
(Refer Slide Time: 18:20)



Here the roller which is motor driven ok and this is driven roller motor driven ok A and here it is a plunged top roller with a plunge. So, top roller I am drawing with a red color top roller and which is plunged ok and material, material moves through this in between this, this material is moving ok. And for this any unevenness this roller will move up and down but the in this instrument the arrangement is there we have to record this.

This movement is very very small because the roving thickness if we see the actual roving this is the type material.

(Refer Slide Time: 19:42)



Here even if we the talk about the variation in thickness and this reflection will be very small. Now mechanically this can be actually amplified, this is amplified by this arrangement here it is a pivoted here and this is ok. Here it is pivoted here and this deflection whatever this deflection here this will get magnified here. This is once it is magnified it is now this movement is actually by the due to the variation in thickness ok.

And it is moving and now from here we can record this thickness variation and a thickness variation is recorded by this is a connector another arrangement is at this point I will draw with other color. This is a connector and here what we have this is fulcrum at this point now this portion will move up and down, this is moving up and down, this will also move up and down depending on, thus this is fulcrumed here.

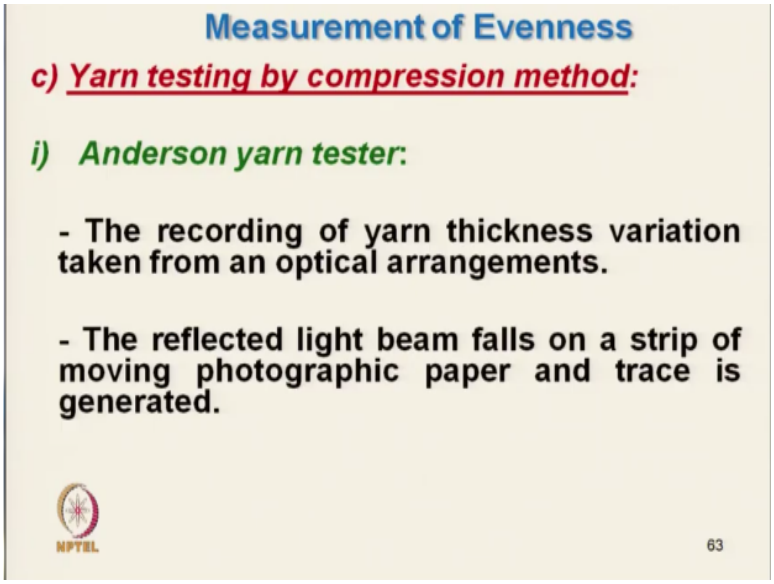
Now from here there is a connector here and this is actually driving connecting with the another system and this system it is a L-shaped L-shaped and which is pivoted at this point. This is on rod ok L-shaped link I can just draw this is the separately. Now here we have different points we can shift it. Now thing is that now as it is moving up and down this will also move up and down as it is connected here.

If it is moving up and down this will move up and down ok the sideway this will make side way movement and with this there is a link and here it is a pen recorder pen is there. This is the pen and a chart is moving, chart is continuously moving and pen will make lateral movement which is nothing but the variation in the thickness and as chart is moving, so this will give this type of motion.

So, this is actually nothing but the diagram this is giving the variation in the material ok, variation in thickness of the material. And if we know the distance exact distance if and this link arrangement we can calculate the exact thickness variation from this part. And the magnification suppose we want we have finer material we have sliver we have finer material. In case of finer material what will have our variation in thickness will be very small**.**

So, that we have to actually amplify, so this way we can what we can do here there are different connector here. We can change we can shift the connector then if we shift the connector this to this then this will get more deflection. So, higher deflection we can change by resetting everything, so this instrument it gives the variation in terms of thickness variation. So, thickness variation we can measure by grove and shoe method or by the levelness tester there are other techniques also which use the thickness under compression.

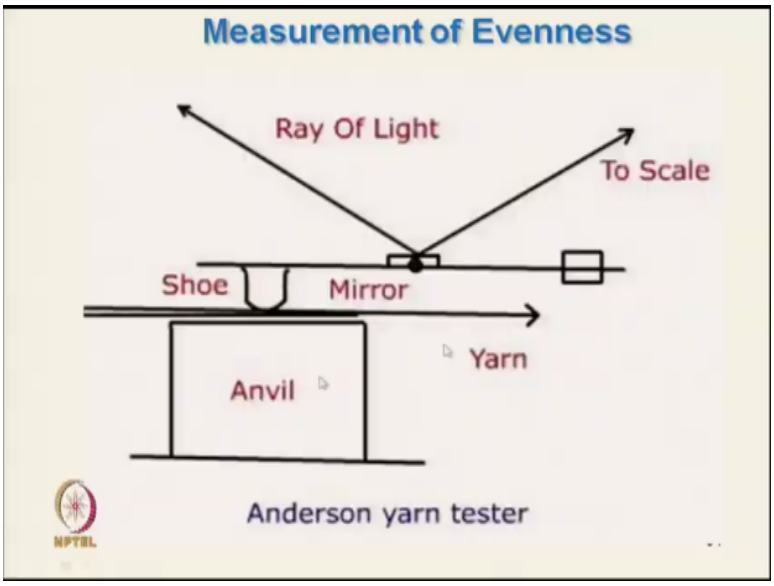
(Refer Slide Time: 24:17)



One is that Anderson yarn tester, Anderson yarn tester it is actually is the principle is exactly same. Here the yarn is tested it is not the compressible material here the yarn is little bit harder material whatever the thickness variation is there that will get actually that is measured here. This recording of yarn thickness variation taken from optical arrangement. Here actually by using light reflection 1 can measure the yarn thickness variation.

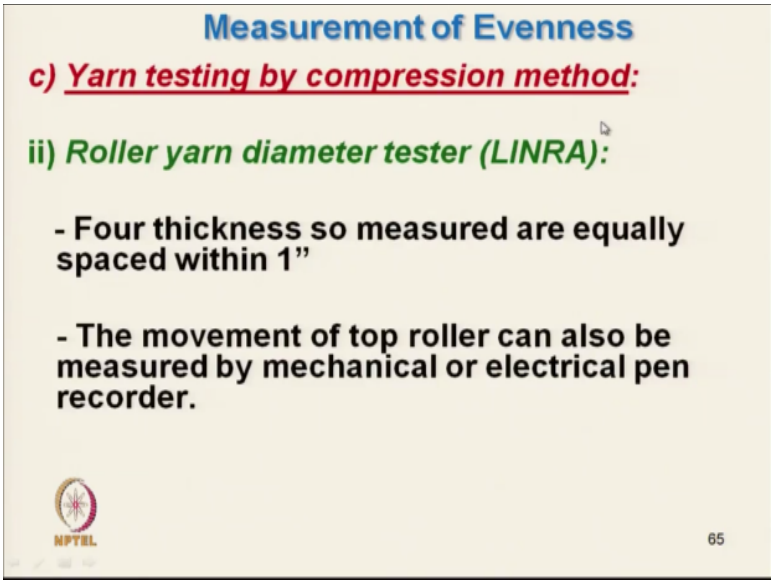
The reflected light beam falls on a strip of moving photographic paper ok, so photographic plate is moving and reflected light pointed light is actually projected on that and trace is generated.

(Refer Slide Time: 25:13)



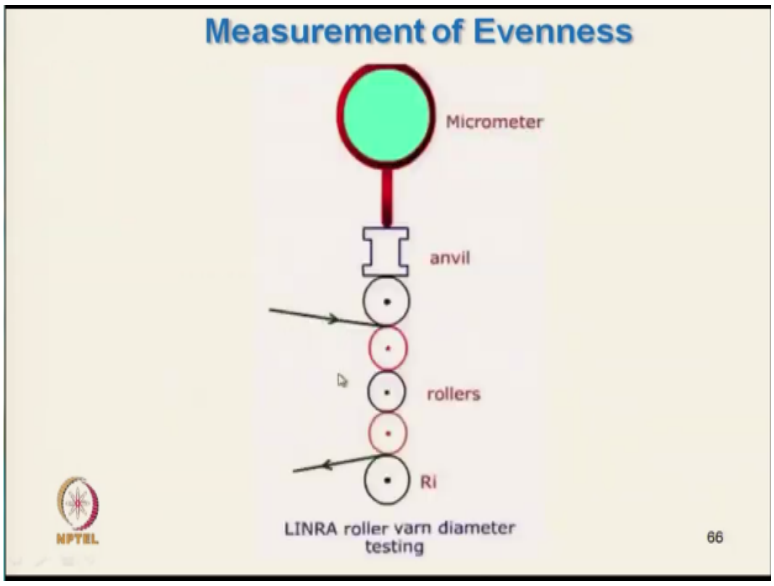
And this is the technique here, here this is a shoe and this is hand wheel the yarn is moving and it is connected with this. Here it is a this is the pivot point and just over that there will be 1 mirror and ray of light is actually falling on it and here it is a photographic plate will be there. And as the yarn thickness changes this mirror will get tilted ok depending on the thickness and this ray as it is fixed ray this ray will move ok that will be a movement of this ray and this movement is proportional to the thickness variation, so that is the principle of Anderson yarn tester.

(Refer Slide Time: 26:03)



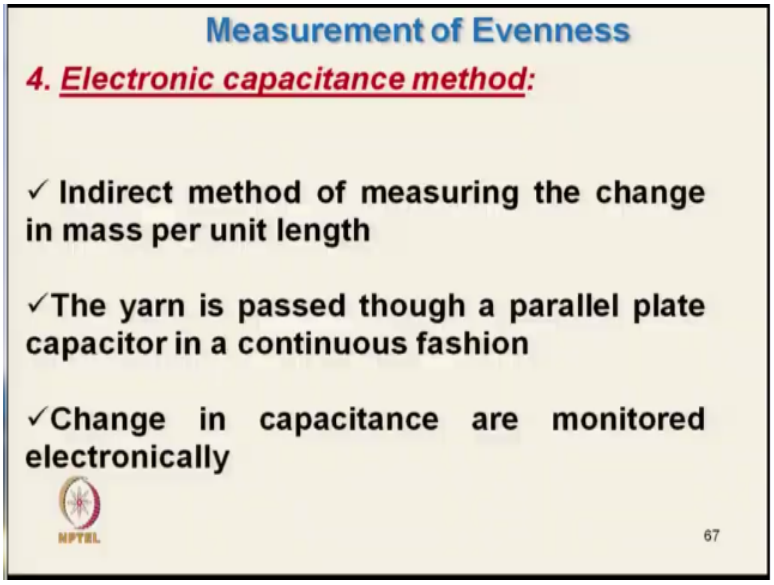
Another measurement is the by using compression it is the yarn diameter actually tester roller yarn diameter tester it is a simple tester where.

(Refer Slide Time: 26:15)



This is the yarn there are different rollers are there and yarn is moving on this depending on the diameter variation and this will move up and down. And this can be recorded by using micrometer or maybe by electronic arrangement we can directly measure this thickness variation.

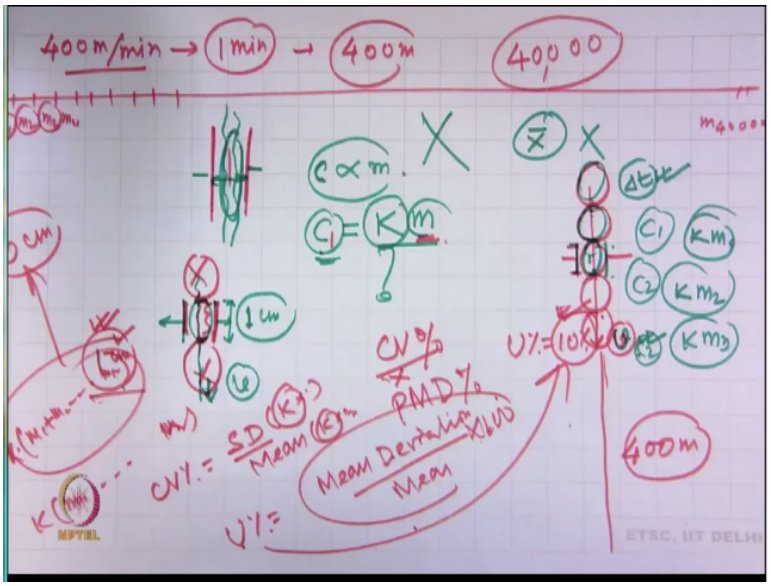
(Refer Slide Time: 26:40)



Now next is that most important which is very widely used the it works on capacitance principle. Now in capacitance principle, the principle here is that the material moves through slot and slot is between a 2 capacitor plate ok. Now this capacitor plate is it is a indirect method of measuring the change in mass/unit area which is very important which we should remember, so in other methods as we have discussed.

Those are the direct method, in capacitors method although it is a very widely used but here the method of measurement is totally indirect.

(Refer Slide Time: 27:42)



Now these are the capacitor plate now if the and it has got certain dielectric constant ok. Now when once the material is there in between material is there this mass presence of material quantity of material it is not volume it is the quantity of material which actually changes the capacitance of this plate. So, the quantity is nothing but the mass of material ok and the capacitance is proportional to the mass of material changing.

So, capacitors it is not change, it is a capacitance of the material of this capacitor is proportional to the mass. If mass changes then capacitance change that means are we measuring mass no we are not measuring mass, we are measuring certain value of capacitance value which we know it is a proportional to the mass of the material. We are not we from this instrument the negative point is that from this principle we cannot get the value actual count of the yarn.

We cannot get the actual mass/unit length of them x bar we cannot get although we get the variation. But variation we want, so this instrument this capacitance principle although it measures the variability in terms of mass/unit length. But it is only limited to that, so this instrument it is expect we cannot expect to give the value of mass/unit length it will not give, it will only give the variation.

So, because capacitance is actually it is proportional to mass so Km this K value is unknown K depends on various factors it depends on the material, depends on the moisture content depends on many thing. The twist level depend on the, so K for a material for a yarn for a particular yarn for a tested under particular condition particular particular fibre K is constant.

So, with that assumption we can measure only the variability I will just come and the yarn is passed through the parallel plate capacitor in continuous fashion ok. And one thing is important the it is indirect method of measuring the change in mass/unit length the what is the unit length. Now say this is the capacitor plate and through which our material is passing yarn or slovy and this is passing through this and the length of the capacitance plate is this.

And normally in normal evenness tester it is typically 1 centimeter that means at any instance the value. So, this it is moving at speed of V the value which the C is getting which is proportional to the mass, this mass of this quantity of within this. This is the quantity what is this quantity length the length here this much length, the C is not taking care of any length any yarn which is beyond this, it is not taking care, it is only concerned with the yarn which is within this zone.

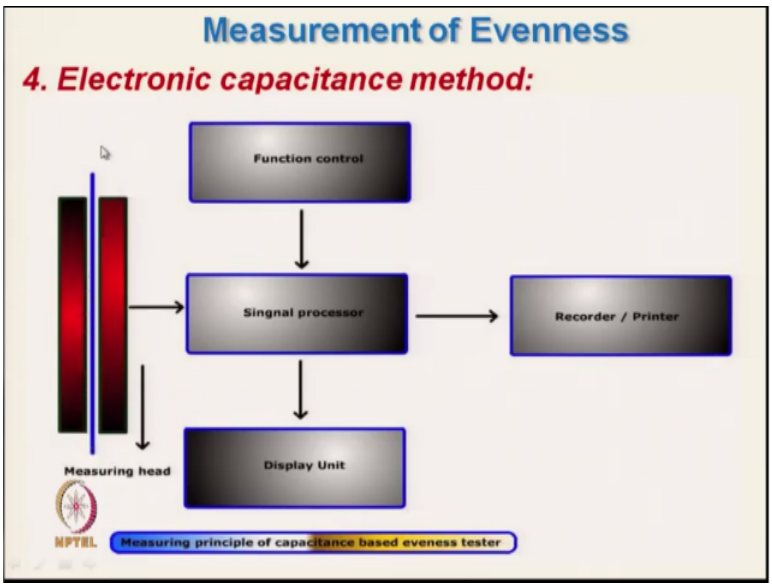
And this condition here is that yarn is the whatever yarn roving or sliver there is an straight moving, moving at straight line. That means the length between this it is a 1 centimeter length which is unit length and this mass of 1 centimeter that means the C is proportional to the mass of this quantity. Now how is taking then C of next value, so C1 is that this portion this is portion 1 now as it is moving continuous, suppose now let me draw once again.

This is the capacitance plate and then the material is moving this is the material at moving at known speed V. Now here this is say 1 centimeter length this is actually measuring the capacitance for this mass ok. So, Km1 this is 1 unit 1, now next it should get it should take the mass of this unit ok, now how will it take, so it has certain speed. Now by that speed after certain time delta t this portion will reach here.

Now the delta t is the frequency that is the time interval for the next reading that is automatically adjusted. So, for next reading what it will do it will not take the data of this overlap portion it will take data of the next portion. So, that we can adjust or maybe after certain distance ok any distance after that but once it is taking the data the softer it sending the signal capacitance signal that signal is actually the mass proportional to the mass of 1 centimeter that is the length of the capacitors.

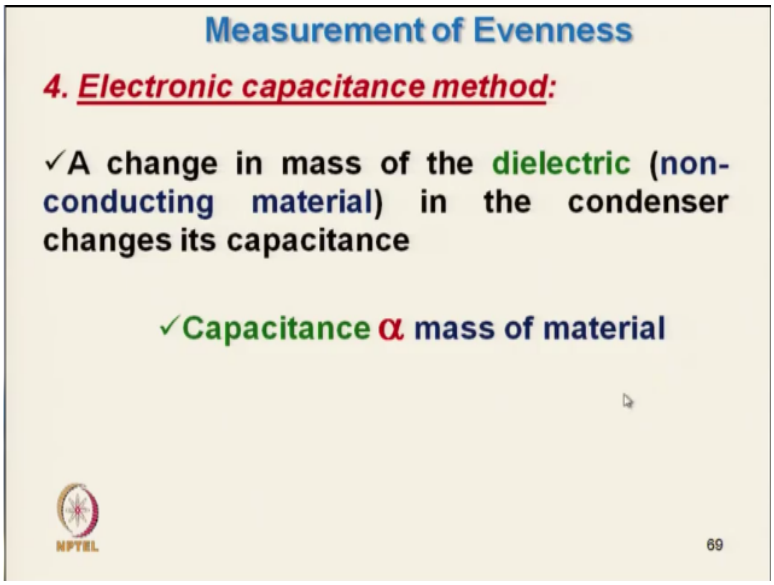
So, that mass is say m2 Km1, Km2, Km3 in this way it will keep on sending the data and large number of data C1, C2, C3 it is only giving the value of C some electrical signal. But we know that value is proportional to the mass value of that ok. Now we have not yet got the value of the exact value of mass ok, we have got only the proportional of mass. That is why here we are talking about only change in capacitance ok we are talking about the variability of the material.

(Refer Slide Time: 35:24)



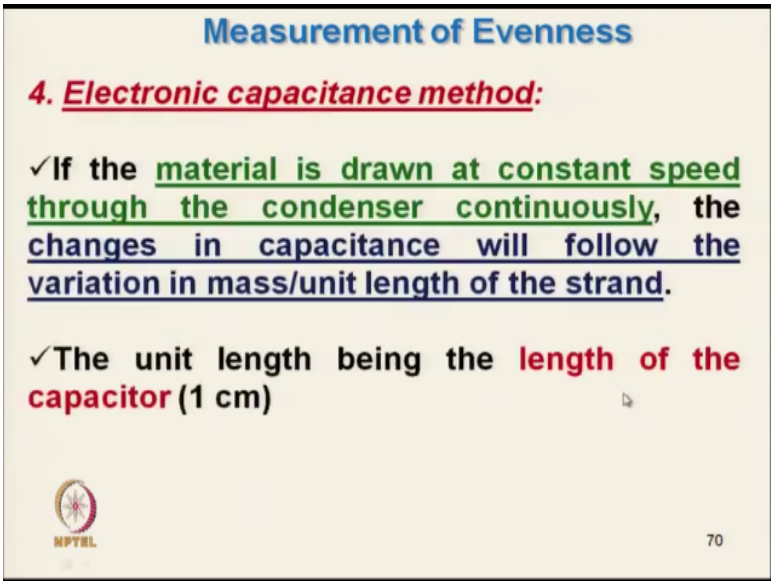
Now this is the principle here it is the measuring head and here the length is 1 centimeter as I have mentioned here and signal processing display you need, recording you need, printer everything is there.

(Refer Slide Time: 35:41)



And then a change in mass of the dielectric ok change in mass of the dielectric material like in our case it is a yarn non conductive yarn material in the condenser changes it is a capacitor. So, capacitance is changing which is proportional to the mass of the material ok, so Km is there capacitance.

(Refer Slide Time: 36:10)



And if the material is drawn at a constant speed through the condenser continuously the change in capacitance will follow the variation in mass/unit length that I have already mention and the unit length being here it is the length of the capacitance for this pushkar tester it is a for most of the winer tester it is a 1 centimeter ok. And also one thing 1 should remember here once we are getting the data of consecutive 1 centimeter ok.

Once we are getting the data of consecutive one say Km1, Km2, Km3 now if I want to measure. Now what we will do we will measure the variability, variability in terms of CV% or %mean deviation. And we will see if we measure the CV% or %mean deviation the as we have will be dividing with the mean standard deviation as we will be dividing standard deviation with mean or mean deviation with mean.

So, in that case you will see standard deviation will be proportional to K, K*something a mean will be K*something. So, this K will get cancelled out in both the cases as K is getting cancelled out, so we do not have any problem why there it is a mass variation or capacitance variation or any electrical signal variation. It is giving the exactly same data because we are talking only the variation.

So, the this type of instruments indirect measurement will only give the variability in terms of CV% or in terms of PMD% mean deviation where the constant factor gets cancelled out. We are getting actual variation ok, now here it is a 1 centimeter length, so now can we get in using this instrument can we get the various**.** So, the percentage mean so now let me tell me you 1 important I can explain 1 important phenomena in this instrument.

Suppose this instrument it is working running at the speed of say 400 meter/minute ok**.** And this 400 meter/minute, so for it is running for 1 minute and using this instrument suppose we have got 1 U% or CV% the % wise it is exactly giving the value of m1, m2, m3. Now if I ask you I will give you the yarn is for 1 meter so it is a 400 meter is being tested ok through this capacitance plate through this capacitant.

So, the total length of yarn is 400 meter and I have got 1 value, so for U% I have got say 10% UV%. This yarn has got U% of 10 ok. Now I am telling you I will give you the same portion, so 400 meter is tested I have collected the 400 meter in a bobbin properly kept. And I am giving you the yarn can you get can you calculate U% without using this machine this instrument only using the cutting and weighing method.

And reaching to this value it is possible first thing we must know what is the this length of the capacitor. Now length of the capacitor we know it is a 1 centimeter, now 1 centimeter, now this total 400 meter yarn what I will do I will cut in 1 centimeter length each. So, how many the such pieces will be there in 1 meter there will be 100 pieces and 400 meter we will have 40,000 pieces of such masses, I am talking about theoretically.

So, it will be m1, m2, m3, m4 like m40,000 then 40,000 small pieces I will what I will do I will take the mass of individual m1 by weighing in a micro balance. Then I have the real data then what I will do I will measure the mean deviation assume the formula. Then I will measure the %mean deviation and I should get the value 10%. So, that is why this say although this will give us the value theoretically but it practically not possible.

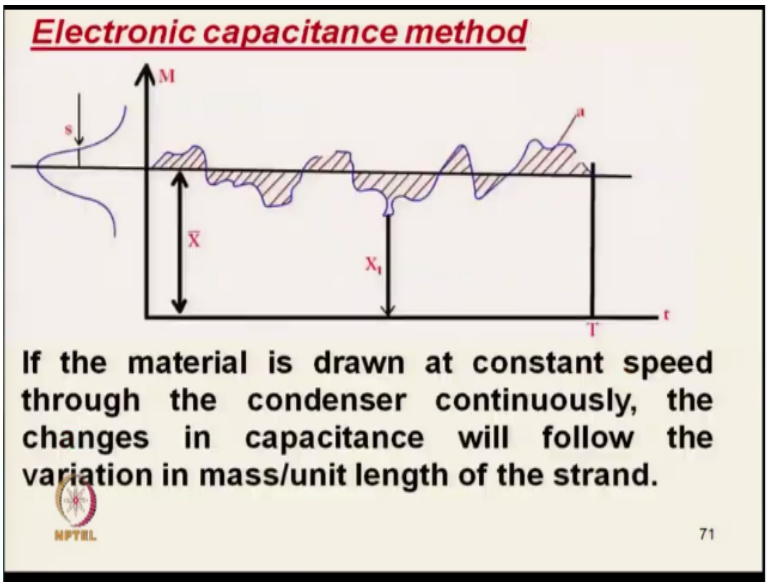
We will exactly same value using the indirect technique of measurement and that to within 1 minute and value wise it is exactly same, only difference is that in this process, in my process of measurement I can tell the yarn is the count of the yarn is 30 tex. Because I know I have the value of the mass/unit length but here it would not give the exact value ok. But it will serve it is purpose because this technique is not for measurement the yarn count.

The technique is the for the measurement of variability of yarn ok that is the basic concept we must know and also this instrument not only give the variation in 1 centimeter although 1 centimeter is the minimum length. We can and unit length we can have variability of any cut length, so U% is the variability of the cut length what is the cut length here cut length is 1 centimeter.

If I want to have want to measure the variability of 10 centimeter cut length it is machine has done is function. Now the thing is the software function what software will do software will only add the this capacitance value of first 10. So, Km1+m2 up to 10 m10 that will be for 10 centimeter, then Km11, m20 second reading. So, in this way it will give, so instead of 1 centimeter, 1 centimeter suppose it was getting 40,000 of reading.

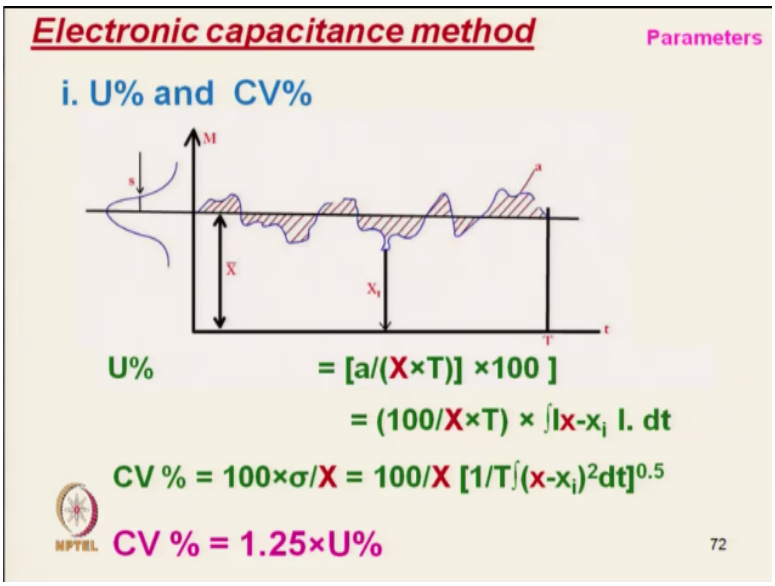
If we try to increase the length then it will get the value number of value will be less, so in this way we can get at different cut length it will give the unevenness value ok and next is that unit length here is 1 centimeter.

(Refer Slide Time: 44:34)



Now try to see here if the material is drawn at constant speed through the condenser continuously the change in capacitance will follow the variation of mass/unit length. So, it is capacitance change it is actually it is exactly it will follow the mass/unit length variation.

(Refer Slide Time: 44:58)

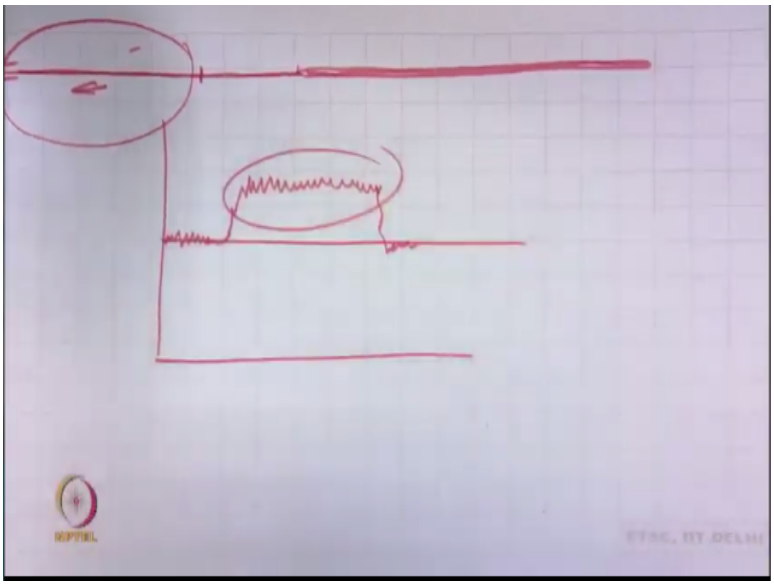


Now how to calculate the then U% from this curve, here this is the variation in mass/unit length as actually are you are getting the capacitance value only thing it is a factor of K. So, factor of K

we know and this is the A, A means area of this shaded portion if we know the mean value. Now the mean is another problem how does the instrument know the mean value you must have if you see the pushkar tester or any winer tester carefully.

Once it is started the instrument is started the screen it remains blank and during initial few seconds it tries to actually get the data of mean capacitance value. And then once it gets the mean capacitance value based on large number initial data it plots this type of curve. This is the mean value ok, mean value of this apparent mean value then accordingly it keeps on plotting**.**

(Refer Slide Time: 46:41)



Now the thing is that suppose there is a yarn initially it is a thin yarn and after that it has got say actually yarn, thin by some mistake ok initial portion thin yarn. Now if we place if we test this yarn in say uster machine or any evenness tester suppose this yarn is moving like this in the capacitance tester it is moving. So, within the initial length it has actually gets the mean value, so this has been plotted.

So, this is immediately plotted within few second, so by that time it has moving, so then it is started actual plotting up to this point this will plot. Then we will see suddenly it has increased this type of plots are possible this shows there is a major problem in the yarn. Suddenly we will find, suddenly it is coming out, so this plot is known as diagram, diagram I will just explain it tells a many thing which no other plot gives even the spectrogram ok, I will just explain.

Now area under the curve, what is that area under the curve, area under the curve this is A which is nothing but the summation of the mean deviation that deviation of from the mean. So, this if you keep on adding this is the mean and this deviation the x-x bar this x is the mean this is the summation of deviation from mean and it is taken the it is a it is taken the mod value, so this is the actual area.

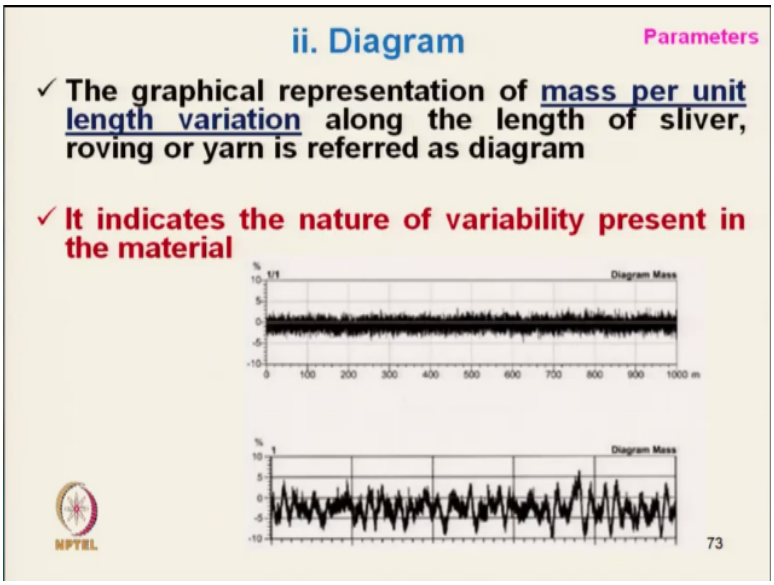
So, if you talk about this and that divide by the t value ok that is a by the number of T what does it does t means t shows the number of readings are taken, t is with a time this is a time axis. But this time is proportional to the number of reading ok now this t this divided by t number of reading it is called the mean deviation. So, what we are getting we measure the area and then divided by number of reading that is in proportional to t.

That gives the mean deviation if we divide it by x that is the mean value that will be and multiplied by 100 it is giving the mass actually the U%. Now here it is interesting here if you see this x and x bar it has got a component of k that is it is giving the actually it is a capacitance value, it has got the component of K if we take out the K outside then this will be the m value mass ok.

And this k value and here also it is k is there with that x value mean value, so this k will get cancelled out. So, ultimately it is basically if we take the U% of % mean deviation of capacitance value and % mean deviation of mass value the meaning the actual value will be same actual numerical it is same ok . Similarly coefficient of variation is also coefficient of variation it is the deviation in standard and then under root ok.

That is the standard deviation divided by mean is the standard deviation we can write in this form and this is the mean and here also it is a the k value gets cancelled out. And for normal distribution we have seen CV is related with mew U value it is by 1.25.

(Refer Slide Time: 51:14)

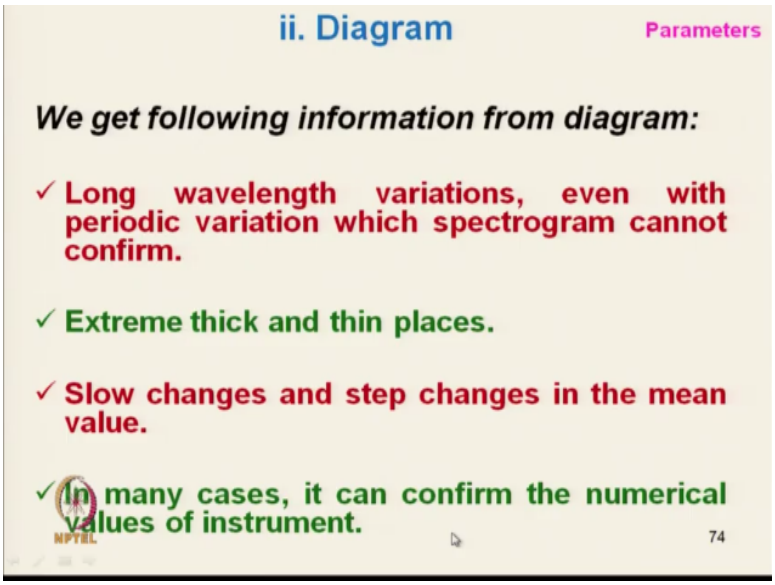


Now coming to one of the most important graph picture which gives the diagram, so the graphical representation of mass/unit length variation along the length of sliver, roving or yarn is reflected as diagram, it indicates the nature of variability present in the material.

(Refer Slide Time: 51:49)

Now this is the this is 1 diagram ok now another yarn is having diagram like this from this looking at this diagram we can make out which one is more clearly we can see that this yarn rate it gives poorer actually evenness ok. This yarn green it is even, so similarly in this picture this diagram ok diagram this one it is even here although there is a variation it is even. But this yarn 2 this one bottom it gives very high variation, it is not that even ok.

(Refer Slide Time: 52:56)



Next is that we get the large number of information large very wide information from the just simply looking at the diagram which we cannot get like long wavelength variation even with periodic variation with spectrogram cannot give. Like the yarn is there spectrogram only gives the variation which is repeating several times, suppose we are testing 400 meters of yarn in 1 meter if it repeats minimum say 6 to 8 times or 10 times then only spectrogram will show there is a variation.

Because spectrogram amplitude vertical that axis, x axis the it is a basically it is a histogram placed very close to each other. And that vertical the height it is nothing but the number of times the fault gets repeated if it repeats only once the spectrogram will not show. But if we see very carefully the diagram, so this is some total length is 400 meter very long length ok. Now if the diagram is like this, this is the diagram.

Now this diagram if we see the diagram carefully of the total length of the yarn this will give there is a very long that wavelength longer wavelength. And it is periodic variation and this variation this type of periodicity that the spectrogram will never show and we can see the nature of the and we can analyze this. Another variation is that suppose the yarn is running it is moving perfectly, it is testing it is going on.

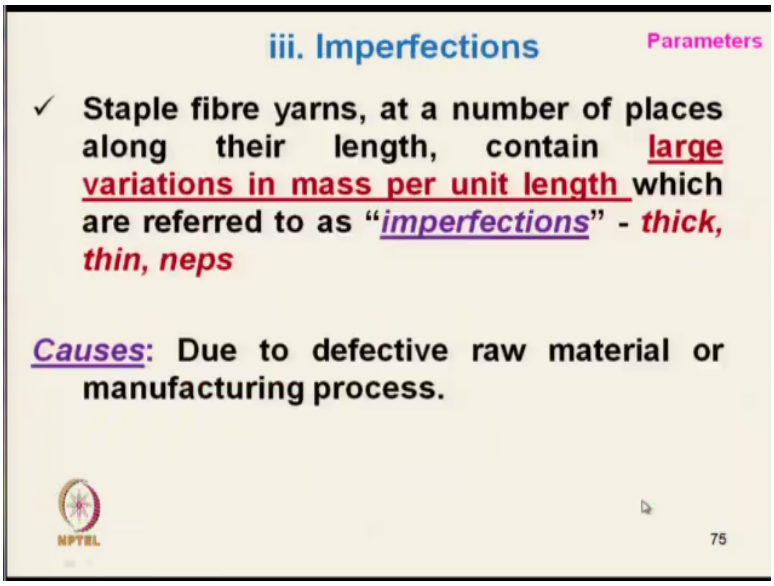
Suddenly in draw frame somewhere there was some double sliver came extra sliver came and it is reflected and that was for longer length, it will not reflect in any other picture. But in that case diagram will show like this for say 100s of meter then suddenly it, so this type of sudden change in mean value will be shown in diagram value not with other type of management ok.

So, long variation even with the periodic variation with spectrogram cannot confirm spectrogram will give some idea but it cannot confirm, extreme thin or thick places as I have just shown. Extreme thick places it will show it is a very high thick place and that even in other data we cannot get only visually the diagram will tell the yarn has got extreme thin place or extreme thick place, sudden change in thick place.

So, changes and step changes in the mean value, so mean value has suddenly stepped out or step down. So, all this variations we cannot get from other method of measurement ok, in many case it can confirm the numerical value of the instrument. So, looking at this value looking at the type of the graph like I will show last time, now here this 2 yarns are there definitely this yarn will give higher in %.

So, that numerical by without looking at the data if we have this values this value this is very useful data is actually that particular value it is dependent on various factors. But if we see the diagram we can make out, so this yarn is very good, we can go for this yarn ok, this is inferior quality, so it can actually confirm the numerical value ok.

(Refer Slide Time: 58:24)



And we will stop here, in next class we will continue with this with there are various ways of expressing the unevenness ok, thank you.