Science and Technology of Weft and Warp Knitting
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Module - 5
Lecture - 20
Fabric Analysis - Influence of Loop Length

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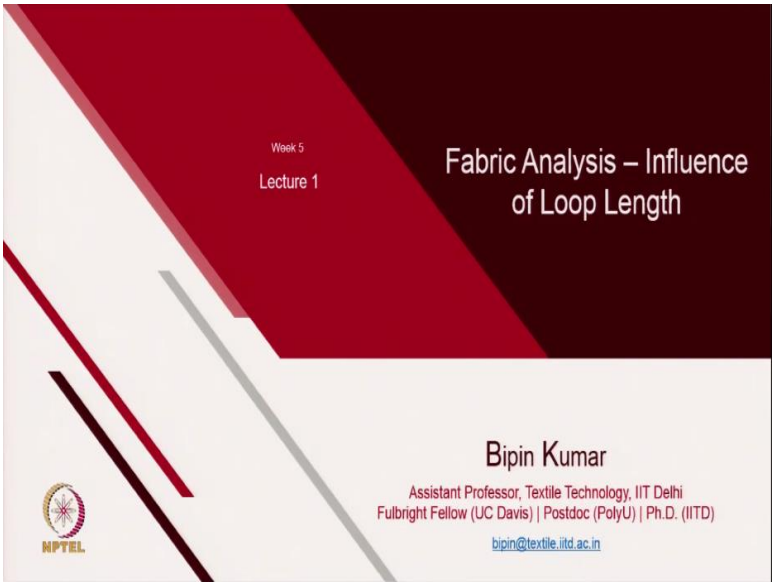

Welcome participants. Now, we are moving to lecture series in week number 5. In this particular week, I have decided to give you many, many lectures. And here, in all of these lectures, I am going you to show different fabric samples, which I created mostly on single bed and V-bed machines. And also, I will let you know the fabric of structural characteristics of these type of fabric designs.

Though in knitting the designs are unlimited, but all of these small examples will help you to proceed in fabric designing and analysis. So, I expect all the bachelor and undergraduate students to follow some of these examples. They can create the samples on their machines and they can also do the analysis. So, in this way, you can learn the, in lot about knitting fabric structures, as well as their characteristics.

So, we start with the first lecture in this series, in which I am mostly focusing on influence of loop length in the fabric structure. So, when you change the loop length, how the fabric will behave; how the structure will look; what changes you can expect in the fabric, in terms of

thread density, GSM, stitch density. So, today's lecture is all about that. So, let's, before I start this week, a quick recap of what we have covered in week number 4, so that you can connect those lectures with this particular lecture series. So, in week number 4, I introduced to you single jersey and double jersey fabric structure.

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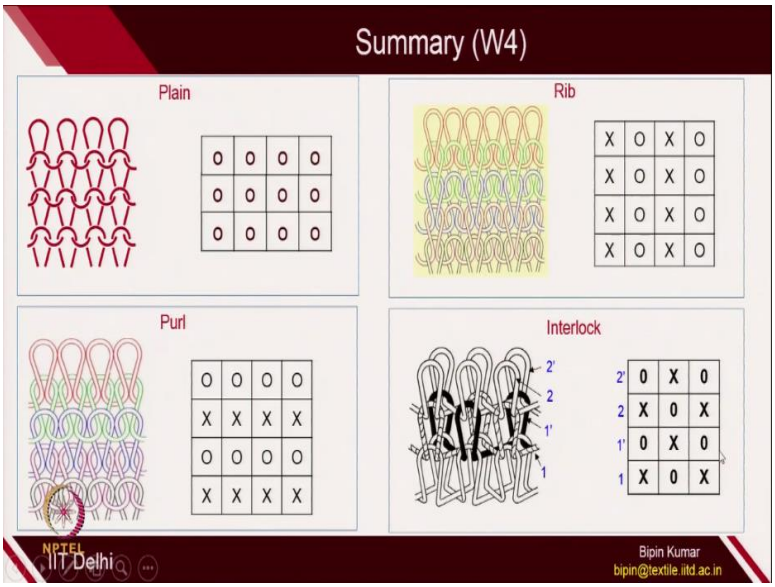

So, depending on what type of machines you are using, whether it is a single bed machine or double bed machines, you can make different set of fabric structures. Plain fabric, where you have all technical front loops. Rib fabrics, where you have technical front and back loops alternatively in the same course. Purl fabric, you have different machines where you have to transfer the entire loops from one bed to another.

And interlock fabrics, where you have 2 sets of needles, long butt needles and short butt needles in the same bed; and you are actually creating 2 rib design in the same course. So basically, you are feeding 2 yarns. In the first feed, in the first course, long butt needles are making technical front; long butt needles of the back bed is making technical back. In the second feed, they are doing the opposite nature.

So, short butt needles of the front bed or the cylinder bed is making technical back. And the other needles, they are making technical front on the dial. So, 2 ribs are actually intermeshed here. So, these are the 4 fabric platforms where you can create any design. And for creating any design in all of these fabric platforms, you can play with the stitches. What do you mean by stitches?

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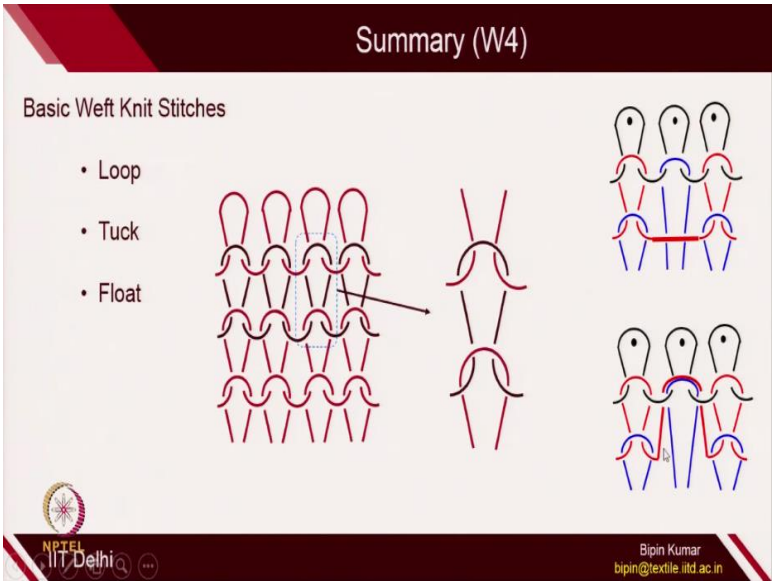

Basically, you can have 3 stitches: loop stitch, where you have 4 intermeshing points. So, you need to create 3 needle loops, which you have shown here. So, 4 intermeshing points are, has to be created to make a complete loop stitch. In tuck stitch, you basically, the old loop is not cleared and the needle catches the new yarn. You can go through those lecture. And here, you are actually missing 2 intermeshing points, because the old loop is not there.

So, 2 intermeshing points, especially at the bottom part, at the foot part which is missing in the tuck loop. So, that's why the tuck become open. In float part, the needle do not releases the old loop, but, and it do not catches the yarn. So, in that case, the no loop is being created and the yarn simply will be present in a straight segment, especially at that locations. So, with these 3 stitches, you can put these type of stitches at any location in all of these fabric platforms and you can create unlimited designs.

So, in this lecture series, basically we are going to make some of the fabric designs which are widely popular in industry. And also, we might have seen these type of fabric designs in our daily t-shirts, sweaters, cardigan designs, Milano designs. So, all those designs are quite popular in the market. So, in this particular week, we are going to cover some of these designs. And will see how the fabric behaves in all of these designs. We have also covered the fabric notations.

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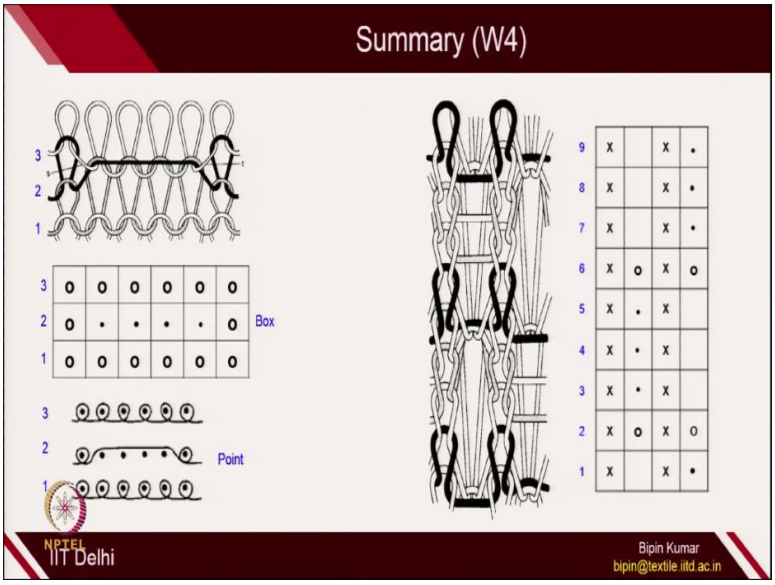

Although, the designs might be unlimited. So, you need to be very thorough with the box and point diagram methods to at least visualize or understand how the fabric will be being formed on the machine. So, box notation is much simpler, but point notations is very useful, because it will give you how many needles has been used; how the yarns has been following; when it is making or doing knitting process in, on the machine. So, I hope you might have given sufficient time in doing these type of fabric notation. Now, we move to this particular lecture.

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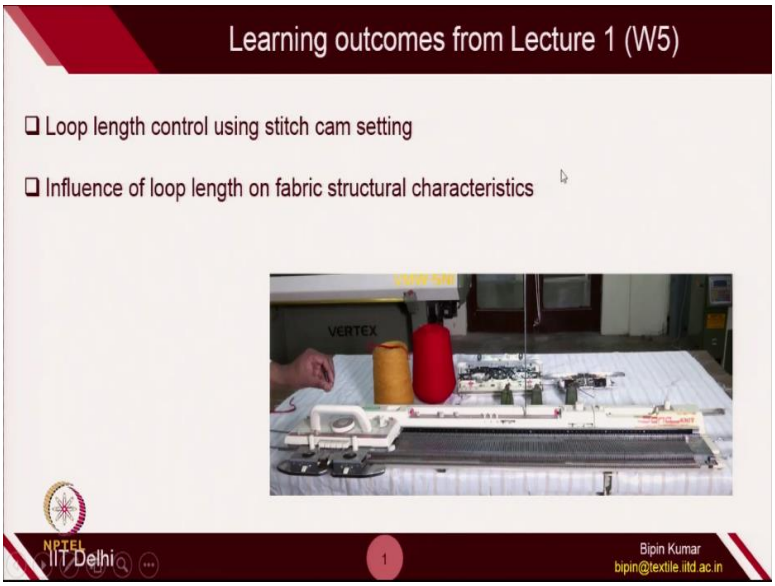

So, in this particular lecture, I have taken a very simple topic. When you change the loop length, with the help of stitch cam setting, how the fabric structure will behave; and how the fabric structure will look; what the changes you will expect when you change the loop length? So, first of all, I will introduce you how you can control the loop length on the machine. This is the single bed machine from week number 2. And once you create or change

the loop length, how that loop length control fabric structure. So, these are the 2 things we are going to learn in this particular lecture.

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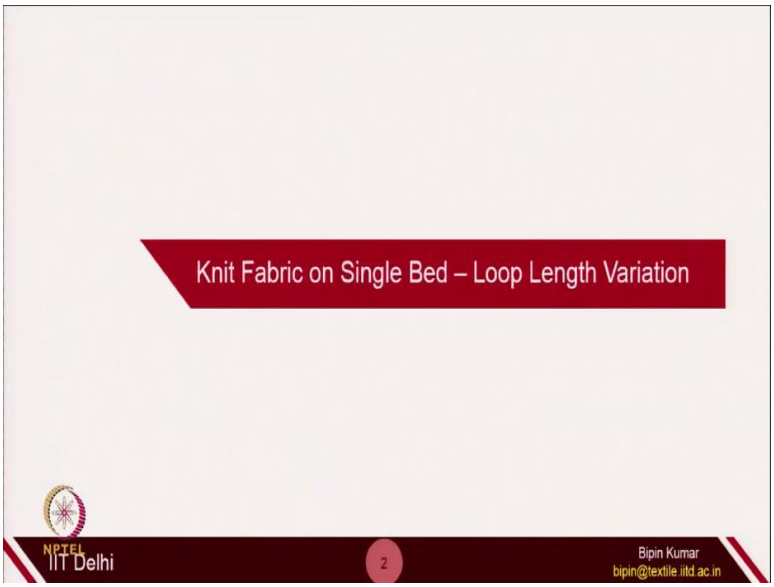

So, let's start from the loop length variation. How do actually we achieve loop length variation?

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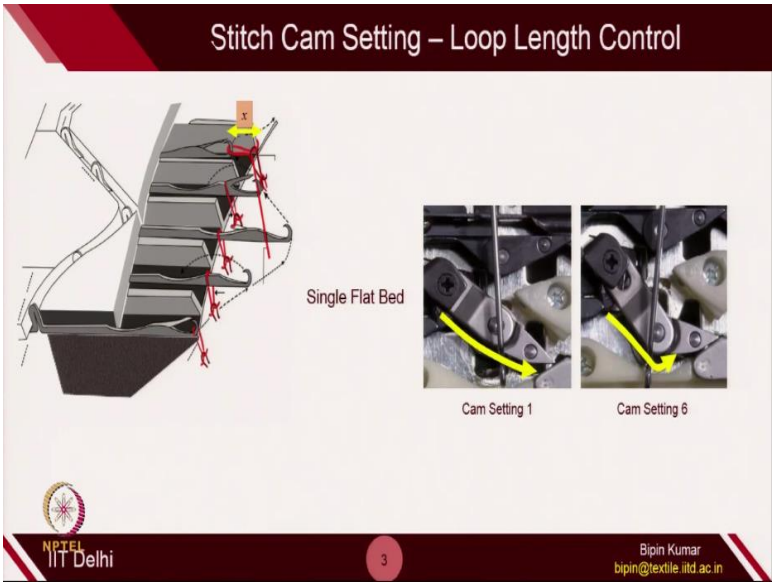

If you remember the week number 2, I have shown you how the needle with the help of a stitch cam descends inside the bed and catches or consumes the yarn. So, depending on how much the needle descends inside the bed, it will decide how much yarn it can consume. So, stitch cam has to be set on the machine to create a particular amount of reciprocation of a particular needle.

So, if the amount of reciprocation or if the distance that the needle is penetrating inside the bed, if the x is more, then naturally, it will be consuming more length of yarn in loop formation. And the loop length will increase. So, to do so, you have to do the cam setting. So, in single flat bed, if you recollect that lecture, this is the setting. So, in this, the stitch cam is at setting number 1.

And you can follow the butt path. So, the butt will simply go like this. But when you increase the cam setting, the butt has to descend more. So, it means, naturally, the butt has to go even more below, so that it will be pulling more amount of yarn. So, x is increasing, basically in cam setting number 6. So, this is how you control loop length by controlling the stitch cam setting.

So, this cam setting is there on the front side of the cam jackets. So, on the front side itself, you will simply rotate the stitch cam setting. And you can set 1 to 10, depending on what type of loop you want to achieve in the fabric structure.

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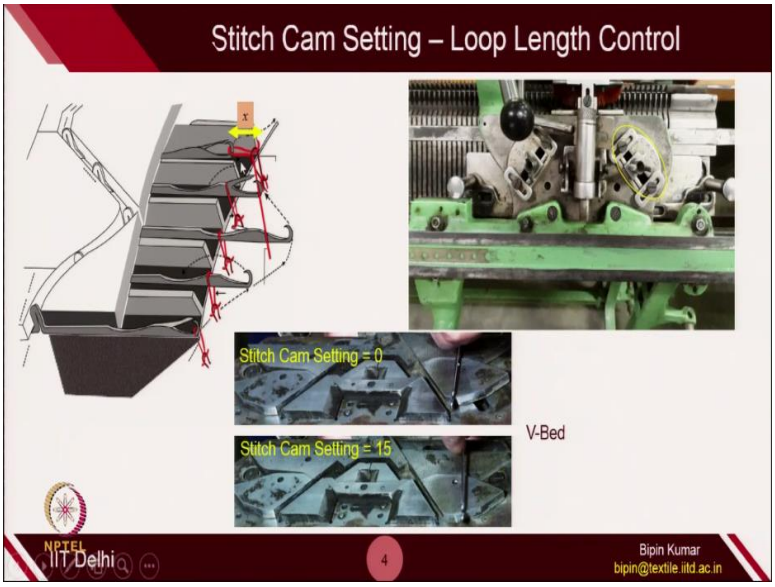

In V-bed machine also, this is the front side of the cam jacket or the carrier. And in front bed, V-bed machine also, you can do the cam setting from 0 to 15. So, this is the basically knob which you can slide along this grove. If you see this particular figure, it is set at location number 6. So, you can set this cam from 0 to 15. So, 0 means the stitch cam is at the uppermost position.

So, it will not allow the needle butt to descend too much inside the bed. But if you set the cam setting at 15, then the stitch cam will push the needle butt to go more inside the bed, to consume more yarn. So, this is how you basically create the loop length.

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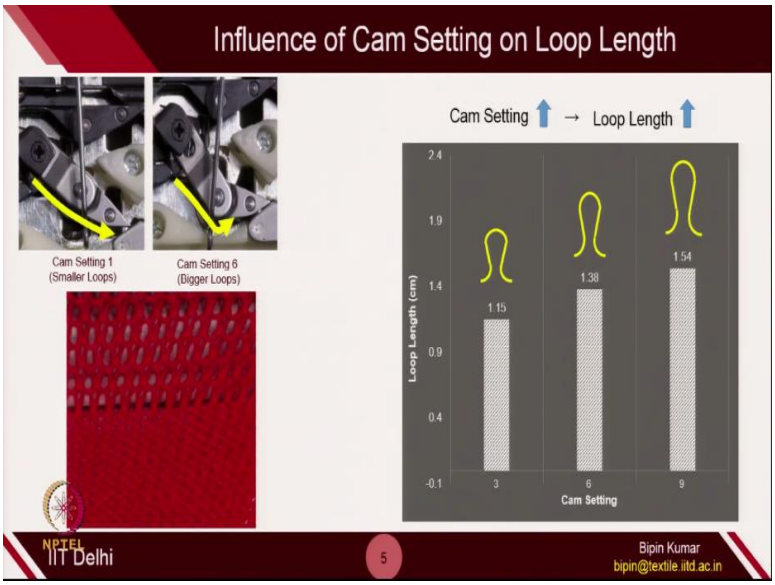

Now, once you set a particular cam, you can control the loop length. So, for example, here you have set the cam setting 1 to 6. And you can create different length of the loops inside the fabric. So, at present, I have created 3 simple fabric structure, by 3 different cam setting: 2, 6 and 9. So, I am going to show you those fabric samples. And then, we will see, how basically these cam setting changes the loop length.

So, let's see the fabric first. So, I have already introduced you the **(Video Starts: 09:50)** cam setting, stitch cam setting especially. So, here I am showing you 3 loops which you can easily see. The first setting is creating a fabric with much smaller loops. So, this is, you can see, the loops is much, much smaller. But if you see this segment of the fabric, the loops is bigger compared to this segment. Okay.

So here, the loop is much, much bigger. And if you see this fabric on the same machine, it has the biggest loop. So here, the cam setting was 9. Here, the cam setting was 6. And here, the cam setting was 3. So, 3, 6 and 9. So, now you can easily see how the fabric appearance is changing. So here, the fabric looks much tighter. Here, the fabric looks little bit open. And here also, the fabric looks little bit open.

So, aesthetics has been changed. And the density of loops on the structure will also change. Because of that, a number of properties can change. So, now let's see, when you change the cam setting, how the loop length is changing. So, I have already given you demonstration in week number 1, how you can analyze the fabric structural characteristics. So, you can take out the yarn, you can measure number of columns, you can measure the length and you can measure the loop length.

You can also **(Video Ends: 11:22)** calculate the thread density, wales per inch, course per inch. You can measure the stitch density, number of loops per unit area. You can also measure the GSM of the fabric, the weight of the fabric per unit area. So, these are some of the basic structural characteristics which you can follow. And that method we followed was the, similar to the lab demo number 1, where I was analyzing the single jersey fabric in week number 1.

So, I expect you to please follow that particular lecture to do the analysis. I have already done this analysis. So, I am going you to show the results what we observed. So, when I change the cam setting from 3 to 9, I observed the loop length was increasing, which I already showed you in the fabric as well. This was the, amount of the cam setting was 3. So, 3 cam setting, the loop length was 1.15 centimeter.

When I changed the cam setting to 6, the loop length was 1.38 centimeter. And when I changed the cam setting to 9, the loop length was 1.54. So naturally, when you are changing the cam setting from 1 to 10, the loop length was increasing. And this is also visible on the surface of the fabrics. So, here you can see, this is bigger loops and this is smaller loops. So, smaller loops, naturally the fabric will become more and more dense. So, once you have a smaller and bigger loop in a fabric surface, the surface will behave differently. Let's first try to see how the surface characteristics will change.

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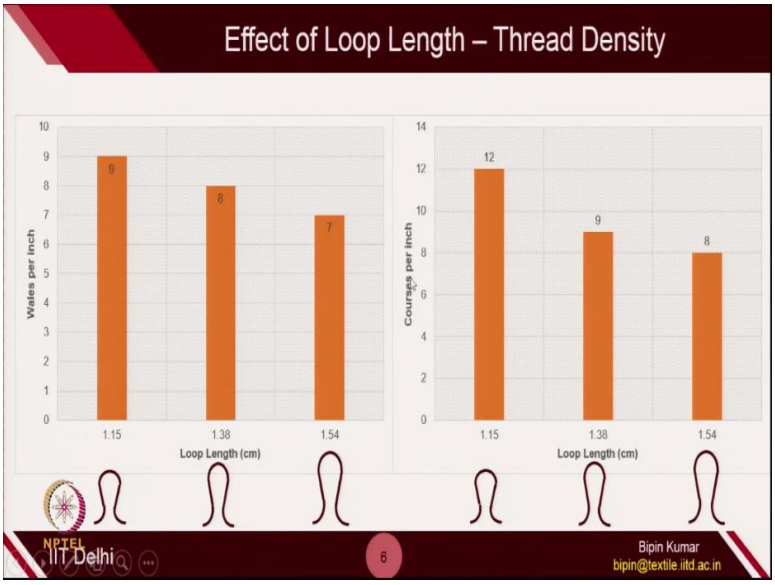

So here, there is 2 things we need to first, immediately observe in the fabric structure is the thread densities. So, how many wales you can count per unit inch? And how many course you can count per unit inch? So, when you are increasing the loop length; so, here the loop length is higher, here the loop length is smaller. So, when you have a smaller loop length, you can count more number of columns of the fabric or more number of wales in the fabric surface.

So here, the number of wales was 9. In this case, the number of a wales was 8. And here, the numbers of wales was 7. And the machine gauge which I was using to create all of these fabric was 6. So ideally, 6 column per inch should be present, but the fabrics shrinks. And because of that, you are observing more number of columns per inch. But, even though, if you change the loop length, you can have more columns that can be present.

So, smaller loop length is giving more number of wales per inch, in the fabric. Now, if you go for course per inch, similar nature also you can observe. A smaller loop length, you can observe much bigger course per inch. So, number of courses per inch you can count in the fabric is much, much higher compared to bigger loop length. So, where the number of courses was only 8.

But, when the loop length was 1.15, the number of courses was 12. And the description is also very similar, easy because, when you have bigger loop length, so naturally, the leg part will be more. So, you can have limited number of loops in the length direction. And then you

have smaller leg part of a loop, naturally you can expect more number of loops in the fabric per unit length. So, this is the nature of wales per inch, course per inch.

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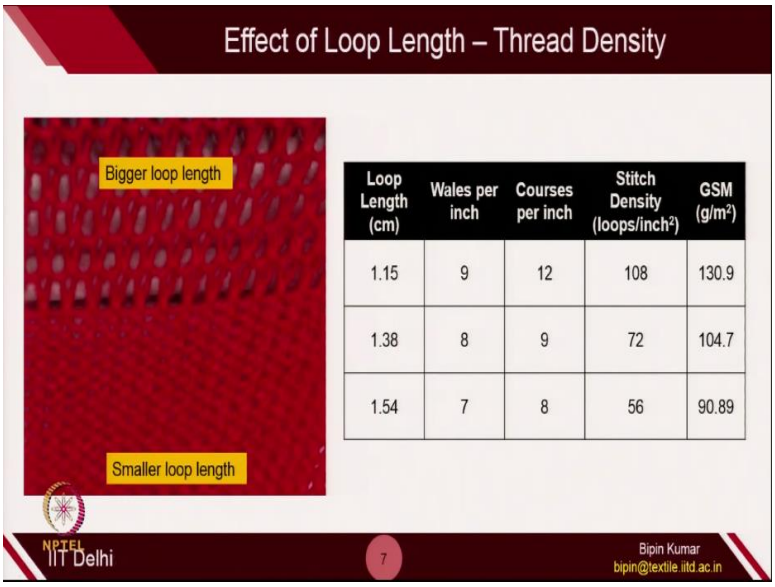

Now, let's see the density. So, when you change the loop length of a fabric, bigger loop length; and if you measure the stitch density, number of loops per unit area; so, when the loop length is lower, you can expect more number of loops per unit area. So here, in 1.15 centimeter of loop length, the stitch density was 108 loops per inch square. When the loop length was 1.54 centimeter, the stitch density was 56.

So, you can see, the number of loops was reducing drastically when you are increasing the loop length. Naturally, when you have lower and lower loop length, the GSM will increase. So, here you have lower loop length. So, you have more number of loops. So, you can expect more amount of yarn per unit area. So, the GSM will be higher. When you go for higher loop length, 1.54, you have lower number of loops.

Although the loop size is bigger, but the number of loops will be much, much lower. So, because of that, the amount of yarn and the weight of yarn per unit area will be less. And due to which, the GSM in the fabric will reduce. So, bigger loop length will make lighter weight of the fabric, because you can see 90.89 gram per meter square. But smaller loop length, you can make higher weight per meter square fabric. So, with simple modification of loops, you can control the fabric weight and fabric density, especially the yarn density.

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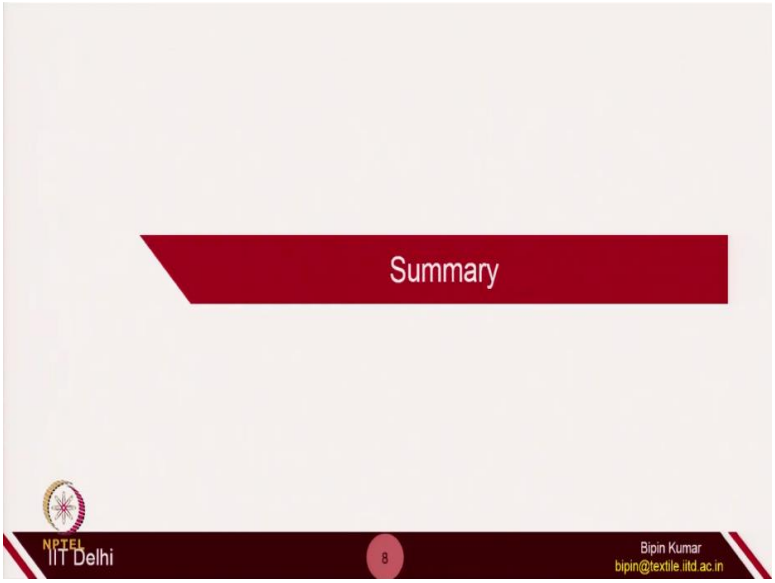

So, let's summarize this particular experiment. So, this is the most simple one. I think I expect any one of you who was listening this lecture, if you have access to the machine, you go and make different loop length fabrics and try to see this variation. So, just the summary.

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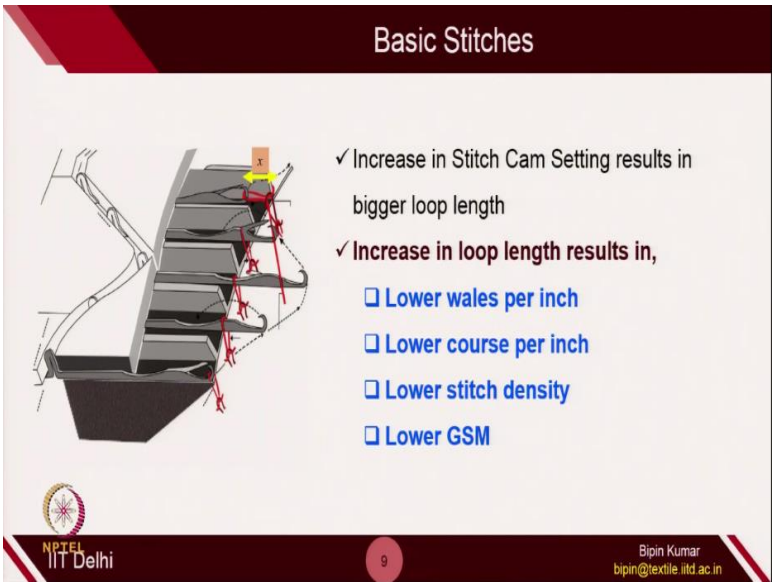

I was making the basic stitches which was the loop. So, when you increase the stitch cam setting, it will results in bigger loop length. And once you have bigger loop length in the fabric, it will result in lower wales per inch. It will result in lower courses per inch. It will also result in lower stitch density, number of loops per unit area. And it will also reduce the weight per unit area of the fabric.

So, it will reduce or it will lower down the GSM. So, loop length significantly effect the fabric structural characteristics. So, this is the basic testing on the knit fabrics. Now, in the

next lecture, I am going to go for more complicated designs and where I am going to changes the stitches. So, stay tuned. Thank you very much.