Science and Technology of Weft and Warp Knitting
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Lecture - 33
Knitting Designs Possibilities

Welcome participants to lecture number 3, here again we are going to go for different designs of knitting using advanced knitting technology. In last class I given you demonstration of how we can create rib designs, purl designs, link designs, tuck designs and float designs. Those were the simple designs on fabric structure. In this one we are going to go for advanced knitting designs where you will be using racking, loop transfer and jacquard needle selection simultaneously.

So let's look to some of these designs, in these designs I will be also showing you the fabric samples I will also show you the needle action on the machine. How needles are operating while making this fabric and also I will give you the future aspects like when you use these designs what type of patterns you can create? Again these are again the sample of few designs which you might have observed in the market.

In knitting there is no limitations from the design perspective, its depends entirely on the designer how much and what designs he wants to create.

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Let's see some of the new designs which is possible on jacquard knitting machine. The first design is pointelle. So let me introduce you and show you the fabric samples what do you actually mean by the point.

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So in pointelle, I am going to show you the pointelle on the fabric structure. So if you see this fabric pattern the different patterns are there I am not going to explain all of these. We will go step by step, let's first focus on this holes okay. So these holes has been created. So we need to observe what exactly the needles are doing on the machine. So these holes are actually pointelle design. So if you if you try to enlarge, so this is how the holes will look like okay.

So there 2 columns of holes and some of the loops are actually missing in these pointelle okay. If you reverse this fabric this you will be observing this on the front side. So this is the front side so you can see here the pointelle and also you can see that columns are actually bending. So if you see the columns instead of going straight, it is bending okay. So this clearly indicates a kind of transfer might have happened on both the sides to create these holes.

And if you see between these 2 column of holes there are 2 columns. These 2 columns where loops are being created on the front side and whenever the pointelle is created the columns either on the left side or on the right sides they are turning the path okay. So let's see what exactly is happening on the machine.
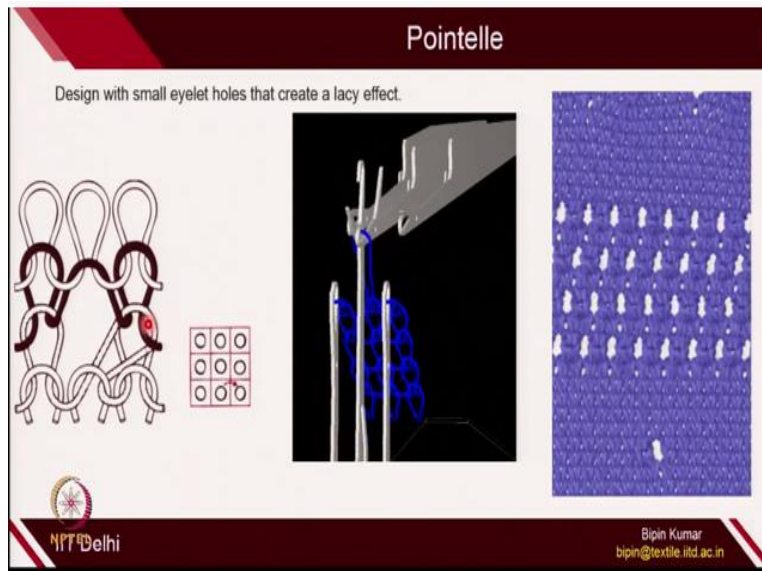
So if you see the pointelle design in pointelle actually its in simple terms its a design with a small eyelet or holes that creates a kind of lacy effect. You might have seen lace fabric in the daily routine where the lot of holes are there on the fabric structures. So pointelle is actually a kind of holes that you create on the fabric structure. So here is the simple loop representation of pointelle.

So you can see all are making technical back loops. So all loops are technical back loops except one, if you see this particular loop this loop is supposed to be making intersection with its upper loop but this loop is being transferred from second column to third column. Because of that there is a free space which has been created here. So this is the free space and this is what you are looking in this fabric okay.

So if you want to see step by step, so this is the first course which was created okay. So this is the first course 1, 2, 3 loops had been created and this arrow indicates this second loop is actually transferred to the third column in the course which is here. After that if you see second course this is the black one, so you created 2 loops and this is again a loop but unfortunately there is no old loop which can hold its lag.

So that's why its open like a tuck, please remember this is not a tuck loop. In tuck loop you have the head along with the old loop. But here there is no head portion unfortunately on this loop has no old loop to secure its lag. So that's why its architecture looks different. In the third row again 3 loops has been created. A simple animation of these loops are shown here on the V bed machine.

So you see what exactly is going to happen here. So first racking is happen and this loop is transferred from one bed to other bed and then racking is happening in opposite direction and then after racking, its transferring the loop to the third column. So this is where the loop has been transferred. After that the loops has been created this is the black one the second course and after that again 3 loops has been created this is the last course.

And in this way you create the fabric structure if you want to see the animation again from front to back then racking then again the loop transferred, so loop get transferred. So first course completed. Then again 3 loops this is the second course and then again third loop which is the third course. So you can see anywhere if you want to create hole you can simply give this kind of command so whether you can shift the loop from left or to right column.

It depends entirely up to the user. So if you carefully see the nature of this column automatically on the surface you will feel that this column is bending. So ideally this column should be following in a straight line but since because of transferred to the next column the nature of the path of the yarn is bending and this is what you are observing on the fabric surface also. If you remember the fabric photos which I just showed you it was bending the yarn path was bending. So this is what is happening in pointelle design.

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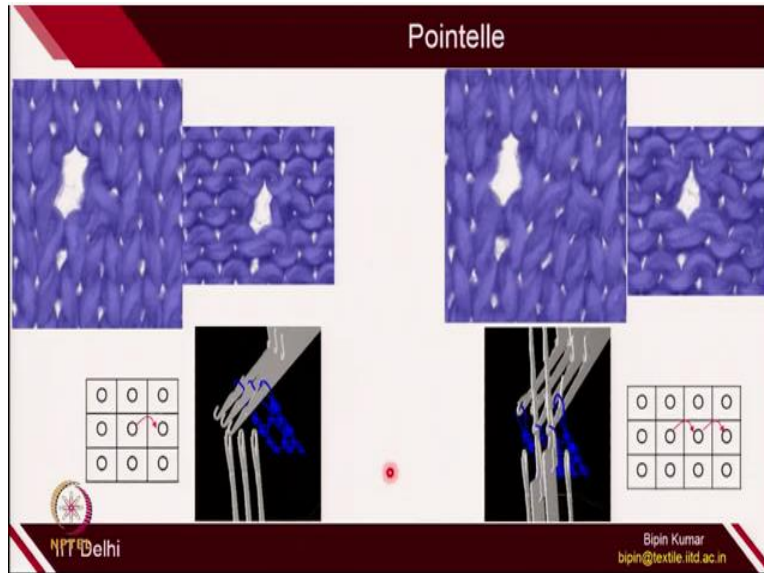
Here I am going to show you pointelle can happens not only on the adjacent loops but simultaneously you can play multiple loops and you can shift all the loops on the left side or right side depending on the designer choice. So here if you see this fabric, the second course the loop is transferred from second column to third column. So at this point the holes will be created. If you see here in the second course the third loop goes to fourth position and second loop goes to third position.

So this place will be vacant. So here actually 2 columns will bend the path so which you can see it here. So 1 column and 2 columns so you can see the yarn is bending and here only 1 column so you can see here this is straight and this is straight only 1 column is bending and while here because this 2 column is transferring. So because of that this column and this column was shifted.

In the fabric sample which I showed you there were more than 2 columns, actually it was 5 columns that was bending. So let me show you once more for more clarification. So if you see here if you carefully see the design. So you can see here from at this location this columns are bending. So actually so 1, 2, 3, 4, 5, 6, 7, so 7 columns you have shifted the loop. So although only 1 hole is created.

But on the sides a very beautiful pattern of bending of loops or bending of columns is observed okay. So this is all about pointelle design. So pointelle is not just limited to 1 loop shift or 2 loop shift. So if you want to see here, you can see here the loops is shifting from 1 column to other column. And if you want to see the animation of this particular loop.

So here you can see first course are made then it is transferred to front bed then after racking this 2 column and this 2 columns are shifted to the back bed and in this way the second position box is vacant and which is shown here in this figure. So this is pointelle design.
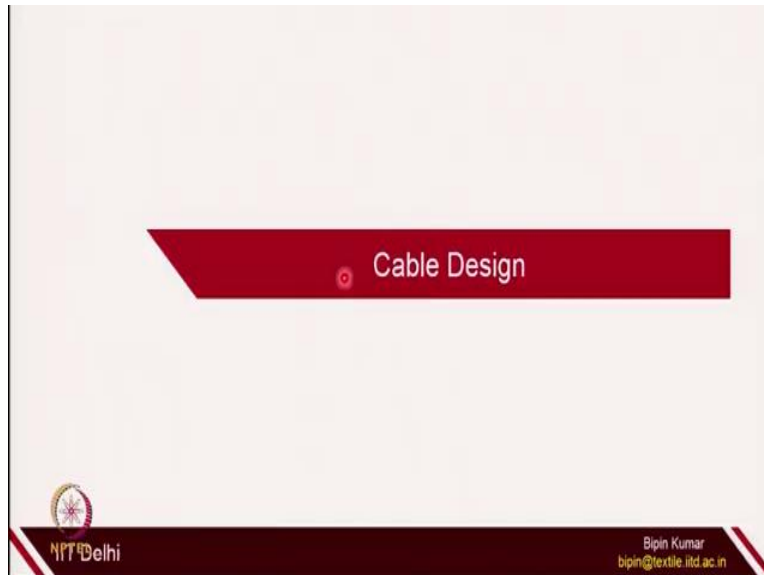
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Pointelle design is gives you a lot of flexibility to create some kind of lacy pattern. So you can see there are lot of patterns which you can created. So everywhere some of the needles will be shifting either left or right. The loops will be shifting to left column or right column. And if you keep doing it a beautiful pattern can be created on the fabric surface. Again it depends on entirely on the imagination of designer. Some of the designs for example this one is very complicated.

Some designs are very simple especially if you see this one. It can be you can use 2 to 3 needles. If you see this one, the pointelle is being repeated in multiple courses. If you see here apart from the pointelle you are creating some other pattern to get beautiful effect. So again pointelle is very-very popular in t-shirts and especially for undergarments and underwears pointelle designs

are being used. In sweaters also you can find lot of pointelle designs and this is very one of the best choice for the designer to create pattern. Now let's move to second one cable design.

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So you might have seen this design in many of your t-shirts or in sweaters. So let's see what do you mean by actually cable design. So in cable actually this is your cable design.

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So if you want to carefully see, so this is how you create cable. This is the fabric so its a very popular one and this is used in sweaters and as well as in t-shirts. So if you see here a very beautiful cable is being generated and also the cables are moving in a random path. So let's

follow the path of any one of the cable. So again this is not like pointelle because any loop is not mixed.

If you see carefully here, if you see here so if you carefully see the 2 columns are these 2 columns on left side and right side are actually swapping its path at this location. So its a intersection point. So 2 columns from the right is going to left and left column is going to right okay at this intersection points. And because of that the cable architecture so its like a ladder. If you carefully see so its like a ladder.

So its moves like a snake okay. On the other surface also the same thing can be if you want to see this one so the cable has been generated but in certain angle. So if you see so here they are switching but simultaneously it is moving in a certain angle. And because of that very beautiful designs can be felt on the fabric surface. So this one the center one is basically we call it in casual terms it is called its cable.

And this design where the cable is changing the path is called Aran design okay. So this is very popular and any type of such designs can be possible. So let's see on the machine what exactly happens to create these type of pattern.

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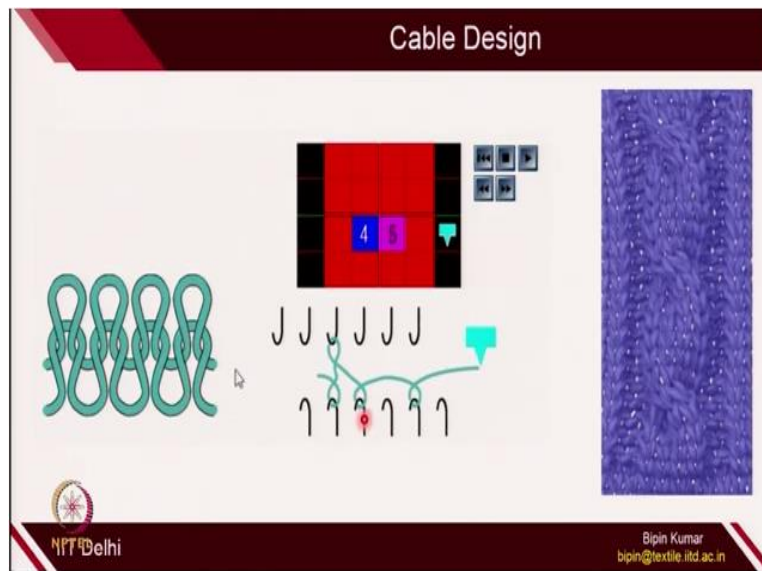
So in cable design for example here you can see 2 columns which I just showed you. So 2 column is shifting from right to left and left 2 columns is shifting from left to right at this intersection point. So this is the intersection point. So this is 1 cross 1 cable where this column is shifting to second column and second column is shifting to third column in second course. And then its keep on making.

So needles remain same only the loops of 2 column in 1 course is interchanged. So if you may interchange 2 loops in 1 course you create 1 cross 1 cable. If you interchange 2 loops exchange with each other then it you create 2 cross 2 cable and when you exchange 3 loops and left 3 loops and 3 right loops exchange each other its called 3 cross 3 cable. You can also create 2 cross 1 you can also create 3 cross 1 and beautiful pattern will create it.

So this fabric is having 2 cross 1 because 2 columns from the left and 2 columns from the right is switching. And let's see the animation here what exactly is happening so the 4 loops has been created on the first course which is here. So this is the 4 loop which is created. Then you created another 4 loops. Now you want to transfer it. So first you transfer the right one on the left and left one into right.

If you want to see the animation again so first course, second course then you are doing racking transferring to the front then transferring the other loop to the other columns and this is how the cables is created and you get a this kind of pattern.

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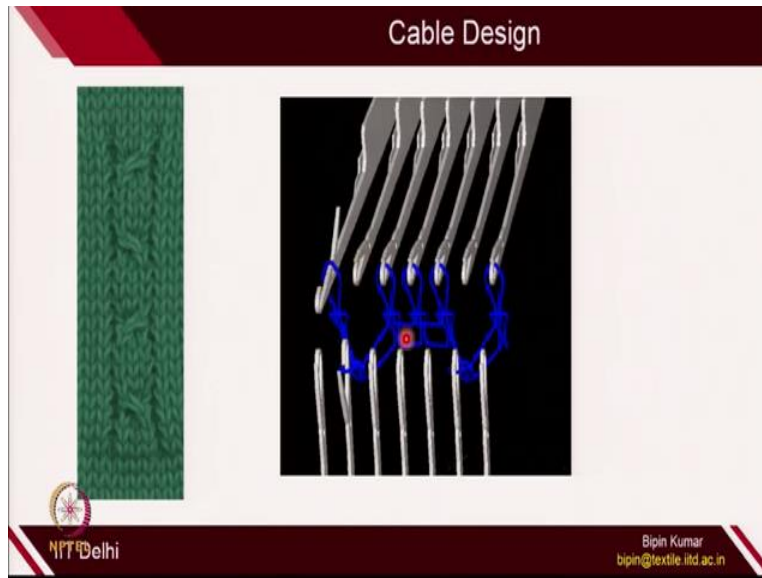
This is actually 2 cross 1 cable. So 2 column and 1 column are actually swapping in one of the courses. So imagine this is the 3 loops 3 columns and which is swapping with each other. So this 2 is going on the right side and the right side loop is going on the first one. So let's see what is exactly happening. So first loop is being created then these 3 loops is transferred on the front bed then its shifted then the rightmost is going to the left and left 2 is going to the right.

So here you can see it has been exchanged so at this point. And then if you keep continuing it again if you want to exchange you can do the same pattern after again 3 courses you do the exchange and this is how you create a very beautiful cable type structure or its like a snake type structure. Because the movement of yarns looks like a snake.

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In cable design lot of possibilities are there and very beautiful effect on the surface can be created. So again it will entirely depend on the imagination of the designer but the concept remains same and you can play and exchange the columns in such a way that the beautiful architectures can come out on the surface. Because whenever you are transferring 1 loop is on the top of other loop and because of that some projection will come and because of that all this projection you are looking here.

So whenever you are transferring some loops are overlapping other loops and because of that the surface will reach and that will give you a certain pattern. This cable is again the most popular choice by designers in creating different types of designs on the fabric surface. Now let's move to the third part which is fabric bulging.

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So bulging is like if you want to create any 3D effect. If you want that the fabric should make some kind of 3D appearance the entire fabric surface goes up. Then you call those designs as a fabric bulging. So this is actually the bulging.

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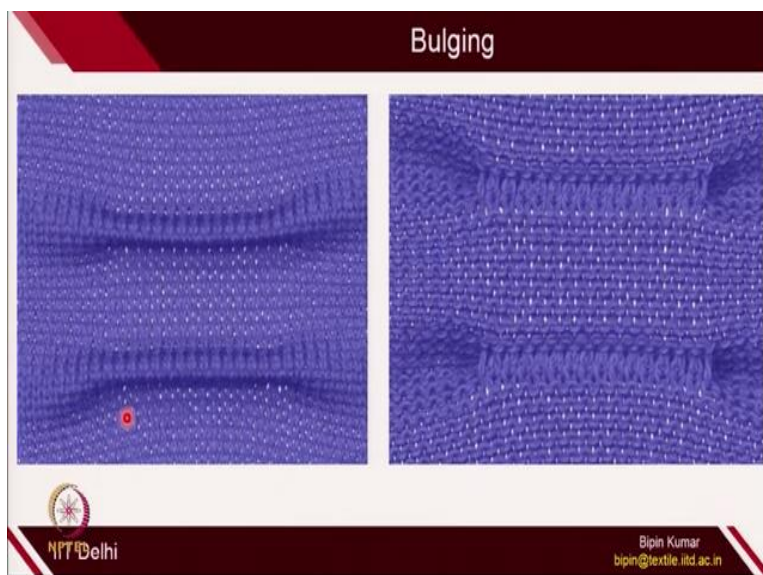
So if you see this is the single jersey loops and suddenly in certain courses because of the action of the needle the course is actually raised from the surface. So this is called bulging because the loops at this location actually bulge out of the plane. So let's see this is the front side and this is the back side. So on the back side these loops are connecting multiple courses and because of that the opposite side certain section of loops actually bulge out.

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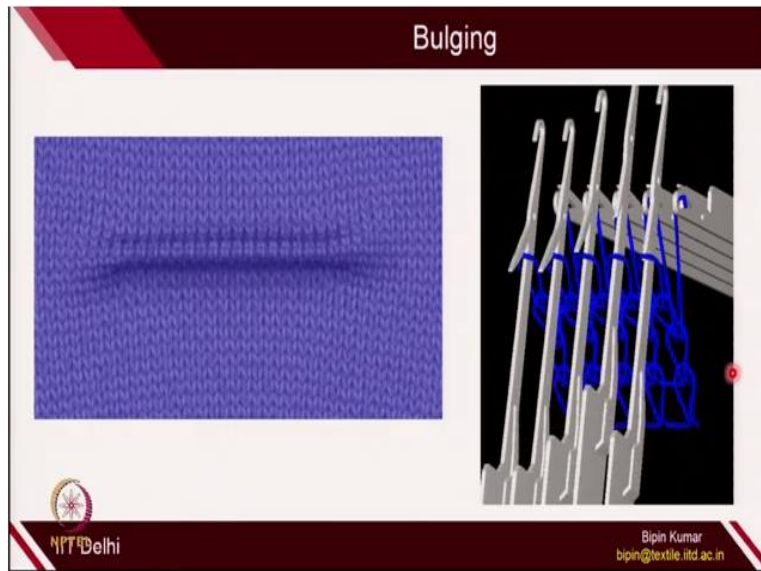
So how do we actually create this kind of bulging a kind of 3-dimensional effect on the fabric surface. So here a simple animation is given to you. So first you create on the both side loops then you keep making loops on 1 of the bed and other loops on the other surface is resting on the back bed. Because of that bigger held loop is being getting created and then you transfer those held loop on the front side.

So you can imagine so you used both the beds together but 1 bed is used for multiple courses and needles on the other bed is resting. Because of that the held loop become bigger and bigger and once you release those held loop and transfer to the front one because of that it gives a strain on the plain of the fabric and because of the strain on the plain of the fabric all the front loops gets projected out from the surface.

So this is what is exactly happening on the surface. All the front loops whatever you have created multiple times keeping back bed ideal. All those loops actually comes above the surface because there is only 1 held loop which is on the back side. So if you see the backside so only one held loop is actually creating multiple courses. So whatever is there at the back of this held loop its comes out from the surface.

So this is called bulging of the fabric. Not so popular in fabric design but again if you want to give some kind of 3D look to the fabric structure its one way of getting the bulging effect on the

fabric surface. 3D loops can also comes out when you use link structure so in the last lecture I showed you in the link when you have technical front and technical back together. So because of the curling nature the surface of the fabric will raise.

So that is another aspect to create 3D architecture on the surface of the fabric and bulging is another one to create 3D architecture.

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Now let's move to the narrowing and widening of the fabric. So whenever we make any garment the size of person varies, the shape of the person also varies. So whenever you are creating fabric on the machine you want some kind of change in dimensions of width during knitting. So anytime you can increase the width of the fabric and decrease the width of the fabric depends on the garment design. So let's see how exactly we do the narrowing and widening of the fabric.

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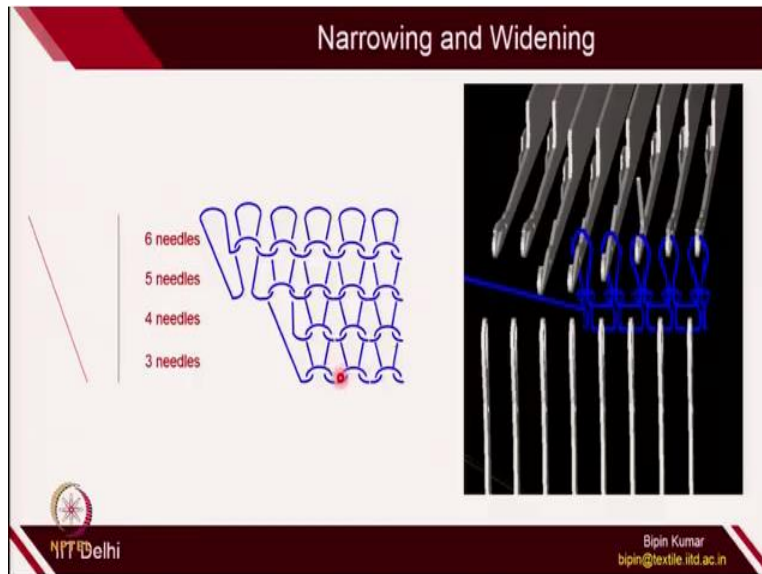
So you start with 3 needles, in the next course you can include 4 needles, in the next course you include 5 needles then 6 needles in this way you are actually widening the fabric because the fabric you are making it wider and wider. Similarly, you can use the transfer actions to transfer the one of the last column to the next column and in this way you can reducing the needle of needle action and we can get narrowing effect okay.

So narrowing can also be done. Similarly, the way widening is happening. So here is the animations and you can see how you can create and change the width of the fabric during knitting itself. So you do not have to cut the fabric sample automatically the needle will take care of the size and shape of the garment. So here you can see the first 5 needles are operating then 6 needles are operating.

You can make certain courses using 6 needles okay. And then if you want you can go for 7 needles so here 7 needles has been used. So in this way anytime you can select any number of needles on the bed on any time you can remove any particular needles out of the bed. So in this way you can do the narrowing and widening. So narrowing and widening is most popular in collars. So let me show you one of the collar design so you can see it here. So when you create the collar so you might have seen on the t-shirt.

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There is a collar design, so in the collar design actually you are doing. So you are first creating the fabric and then you are splitting the 2 section of the fabric. On 1 section you keep doing narrowing and you create on 1 part and in other section you keep doing narrowing you create another V part. So this is how the V designs are being created okay. Not so difficult but its again depends on the action command that you give to the machine at what location and how fast you want to do the narrowing and widening.

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I have another sample of narrowing and widening with link design. So you can see so the fabric just now I told you a bulging effect. This is not the bulging effect but you can see some kind of 3D projection on the loop surface. So this is this is developed by link design. So you can see if

you open up if you I let me zoom for you if you extend it so its nothing but technical front. This is technical front loops and this is technical back loops, this is again technical front loops.

So front, back, front, this is front, this is again front, this one is again this part is back, then front, back. So this is how you create. So once you release the fabric because I have already shown you single jersey fabric has a tendency to curl. So all these technical front loops will have the curling pattern. Similarly, all these technical back loops will have curling pattern and they will curl in such a way that a kind of 3D appearance will come on the fabric surface.

So this is the 3D appearance. So you can see how the pattern is looking. Its very-very complicated but trust me from the loop architecture the fabrics design is very simple. But the appearance is very complicated and its because of the curling nature. So once you create the main body then you can go for narrowing and widening and you can create V pattern. So here on this segment first you split these needles into 2 segments and on 1 segments you keep doing the narrowing and other segments you keep doing the narrowing.

In this way you create V but similarly you can create U type of architectures it depends again on the imagination of the users or designers to give respective design effect on the garment. So this is what is called narrowing and widening.

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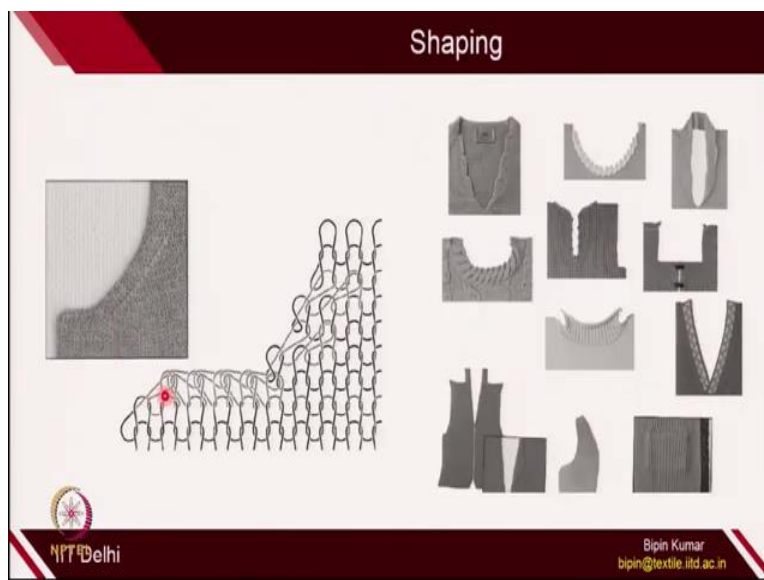
So narrowing and widening is I just showed you its very popular in shaping the garment. So V neck, a round neck whatever neck you want to create you can use this shaping and narrowing. So here you can see how this structure has been created. So you created initially so many columns and then you are narrowing it by shifting the loops on the next column. This is how you are creating the fabric structure. So you started from multiple columns and at the end you are only having 3 columns.

So this is how you do the shaping. So in shaping please remember its always racking and loop transfer both are happening together. Because racking has to be done because the needles has to be first shifted from 1 bed to the opposite bed and then racking will happen and then opposite bed will shift needle back to the next column or loop to the next column, this is how loop transfer. And racking is the most fundamental functions you must look in a machine if you want to create these type of pattern.

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Another thing which is very popular in knitting is 3D shape knitting. So not only V neck and round neck we create but also we can use the concept of narrowing and widening to create 3D shape knitting. So for example if you want to make a fabric pattern which can fits on different architecture different 3D shape object, you can first creates its pattern. So for example if you want to make a circular fabric you just need to create a rectangle because a rectangle can be folded to make a circle.

So this cylinder can be converted into rectangle and then you can do the knitting which can fits into circular thing and similarly if you want to create fabric which can cover this sphere you can create this pattern. So here you can see you are first widening it because you started with minimum number of needles and then you are widening it on both the sides and then you are narrowing it from both the sides and this is how.

And then when you fold it, it will become like this. Similarly, when you want to create this type of pattern. This is the pattern, so here you start with many needles and then you are doing narrowing after that you are doing widening and then you are creating like this. So this is called 3D shape knitting of the fabric. Now let's go for partial knitting.

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So what do you mean by partial knitting? Let me show you one fabric sample you might have seen this in any t-shirt design and sweater design. So in partial knitting.

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So this is the actual fabric pattern and you can see stripes are not moving horizontally but it at certain angles okay. So these are not horizontal so its moving at certain angle. So what do you mean by that? So if you carefully see the loops are placed in a vertical direction but if you see certain region especially if you see this region. So from this point to this point you can see so on the same course not all the needles are catching the same yarn.

So in the same course some needles are catching red yarn some needles are catching yellow yarn. So for example if you see this course up to this point its catching yellow yarn after that it is catching red yarn. So if you follow any path along a course so in the same course it is knitting by yellow yarn and after that it is knitting by red yarn at any location. So at this location it is knitting this much needle in knitting up to yellow part and then its catching the red part.

So partial knitting it means all the course in the knitting in the same bed is not doing the knitting with the same yarn, multiple yarns are there in the same course okay.

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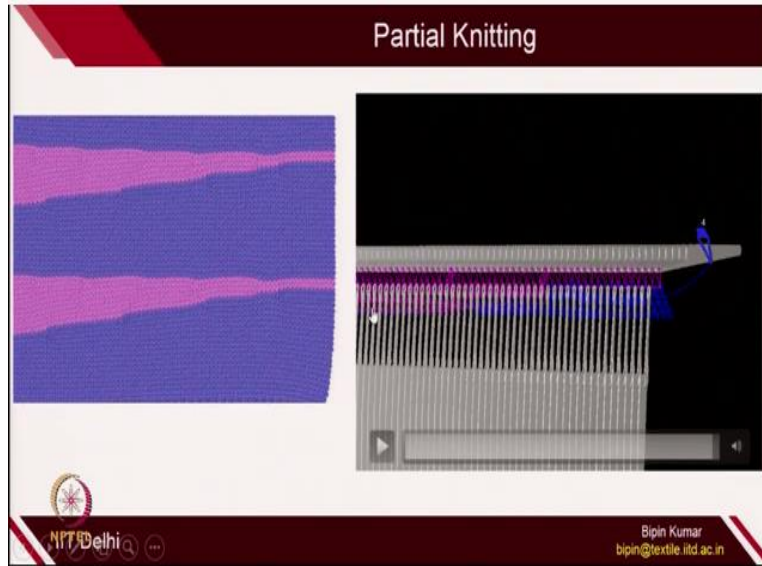
Partial Knitting

So this is called partial knitting. So let's see how we actually make the partial knitting. So this is the partial knitting so you can see here the blue yarn is in the same course the blue yarn is knitting up to this much after that then the rest of the needles is catching the purple yarn. So which can be shown in the animations also. So here you can see first course then blue yarn is actually not completing the entire course.

Similarly, the red yarn is also not completing the entire course. It is doing the partial knitting on the bed and you can see the structure is making like this. So you can if you carefully see the animation so if you see here in this the entire course is knitting in this half of the purple is knitting and half is blue. In the next one more blue loops are there and then rest are purple loops. So in this way actually this kind of pattern has been created. And this is called partial knitting.
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Now let's move to the last part which is my favourite one which is called jacquard knitting. So jacquard is widely popular in weft knitting to create patterns. This jacquard is similar to jacquard weaving machine where you have control of individual bar pian and you can make any pattern on the fabric surface similar fashion you can make any pattern, any shape or anything with the help of jacquard knitting.

So any color can come out any color can be hidden with the help of jacquard knitting. So let's see what do you mean by jacquard knitting. So if you see I am showing you one of the fabric sample.

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So if you see this one so at any point you can hide colours. So for example here red color is visible then yellow color is visible then again red color is visible then yellow color is visible. If you reverse it wherever there is a yellow color on the back side it is a red color okay. So this is your red color and if you see its front side on the it is yellow color. So I am holding it with the help of thumb.

So on the backside this color is visible on front side this color is visible. So any yarn can be hidden any yarn can be shown on the surface. So you can write your name also by different colours on a background. So you can create a background and you can write whatever text you want and that will be visible with the help of knitting yarn. So please do not differentiate this with some kind of printing or designing because we are not doing any printing.

Its just the manipulation of loops on front bed and back bed and you are getting beautiful jacquard design on the surface. Let me show you the principle of making jacquard on the machine through certain videos. So let's move to the first type of jacquard.

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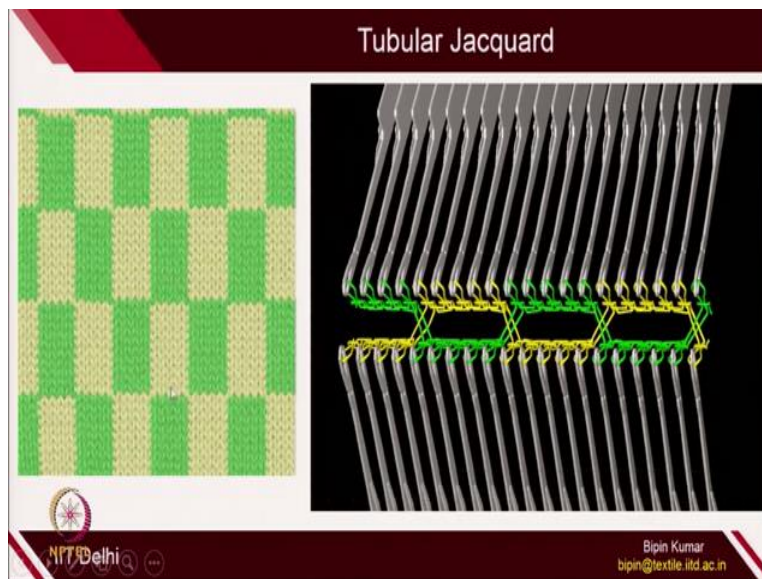
So the first type of jacquard is called tubular jacquard. So in tubular jacquard if you see the fabric so here actually 2 yarns are being used green yarn and yellow yarn. So this looks like white but I am calling it at yellow yarn. So green yarn is visible and then yellow yarn is visible

on the surface then green yarn, then yellow yarn, green yarn and yellow yarn. And if you reverse the fabrics so wherever yellow yarn has visible on that side the green will be visible.

So if you reverse it so green will become yellow, yellow will become green and this is shown here on the machine also. So you are using both the beds and on one side you are knitting yellow loops and on the back side you are knitting green loops so loops from the green yarn. And similarly at this location the loops from the green yarn is coming on the surface and loops from the yellow yarns going on the backside of the surface and then it is reversing it.

So bunch of yellow loop, then green loops, then yellow loops, then green loops and if you reverse the fabric look at on the other side bunch of yellow loops, then green loops, then yellow loops and then green loops this is what is happening here also say bunch of green loops, then yellow loops, green loops, yellow loops. So on the back of green loops yellow loops is hidden. So this is the front side of green loops on the back of this yellow loops is visible.

So this is what you can see it here so first green loops and then yarn making yellow loops again green loops and then yellow loops. So if you carefully see whenever you are doing the transaction a kind of between 2 transaction a kind of hollow pattern has been created. So this is nothing but a tubular jacquard. Because you are using a tube to hide other yarns. So one side 1 yarn is visible and on the backside with the help of tube network the other yarn is hidden.

And if you reverse the fabric surface the same argument can be made. So between 2 intersection you are actually creating hollow pattern or tubular pattern. So this is called tubular jacquard. This is also very-very popular in normal routine and on both the sides loops are there and you can hide any yarn anytime.

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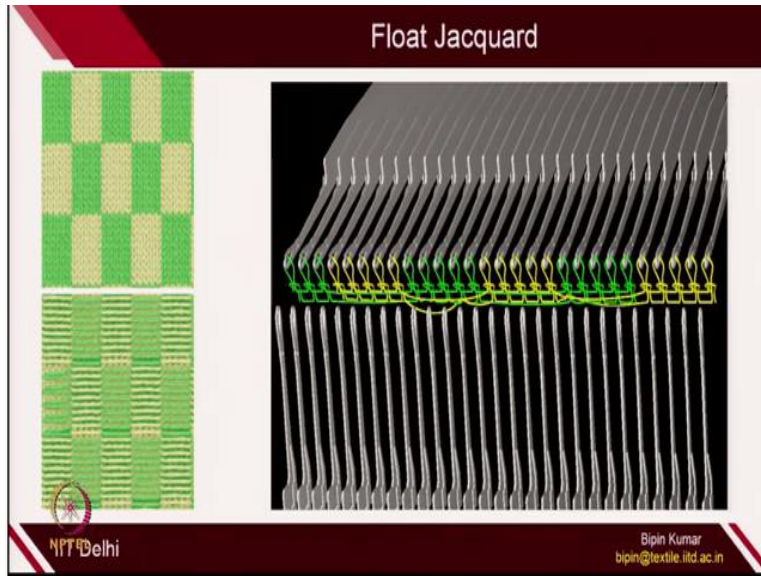
Float Jacquard

Now let's move to the second type of jacquard which is float jacquard. So let me show you the fabric first.

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So in float jacquard, so this is your float jacquard again yellow and red is there and whenever there is a red on the backside actually yellow floats are floating. So on the back side actually floats are floating. So let me show you once more. So here there is a yellow yarn and then red yarn, yellow and red. If you reverse it wherever there is a yellow all red floats are there okay. And wherever there is a red one if you see the red one on the bank of red one yellow floats are there.

So this is yellow float. This is the basic difference between float jacquard and tubular jacquard. So in float jacquard 1 side all floats will be visible which is not supposed to be seen on other surface and in tubular jacquard appearance remain same on both the sides because you are creating tube. So whenever the color of 1 yarn is on 1 surface the color of other yarn will be visible on the back surface in the form of loops.

Here color of 1 yam is visible on front side and color of other yarn will be making float on the back side. So this is how both has been created and to create this jacquard and this jacquard so in this jacquard we can create using single bed. So this is called single jersey jacquard because you just need 1 bed to create this type of structure and this is as I showed you the animation also you need 2 beds to create tubular jacquard.

Although the loops are same if you see the loops they are all technical front loops on both the surface because its a tubular surface. But we need 2 beds to create. So let's see the animation of the float jacquard. So you have on 1 side the yarns in the form of loops will be visible and the other side the floats will be visible and you can create this float jacquard with the help of only 1 bed. So you have just 1 bed. So you can see here.

In the first course only yarn green yarn is making the loops, in second course the yellow yarn is making loops on the selective needle. So and the rest other needles are used in the making floats. So its just floating. So for example these 5 needles are already make the loops and these 5 needles are actually not catching this yarn. So it is remaining in the form of float which is shown here. So you can see it here. So again you can see it here how the green floats and yellow floats align on opposite side.
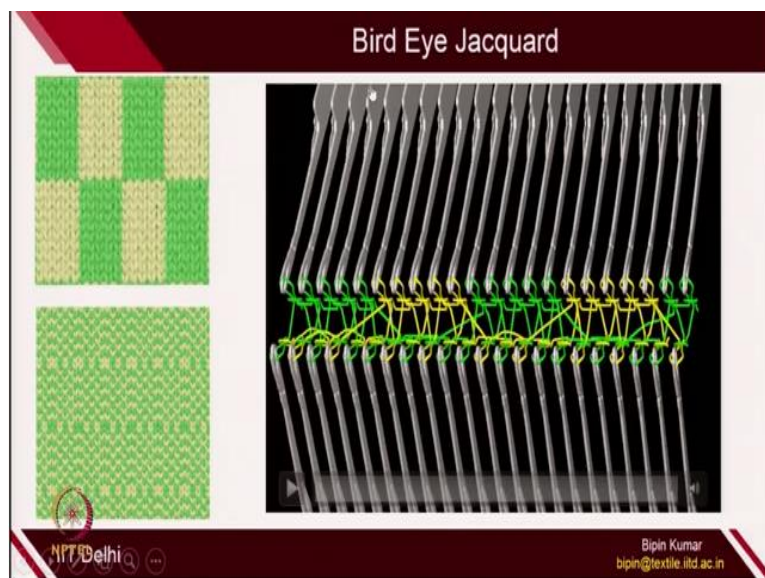
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Float Jacquard
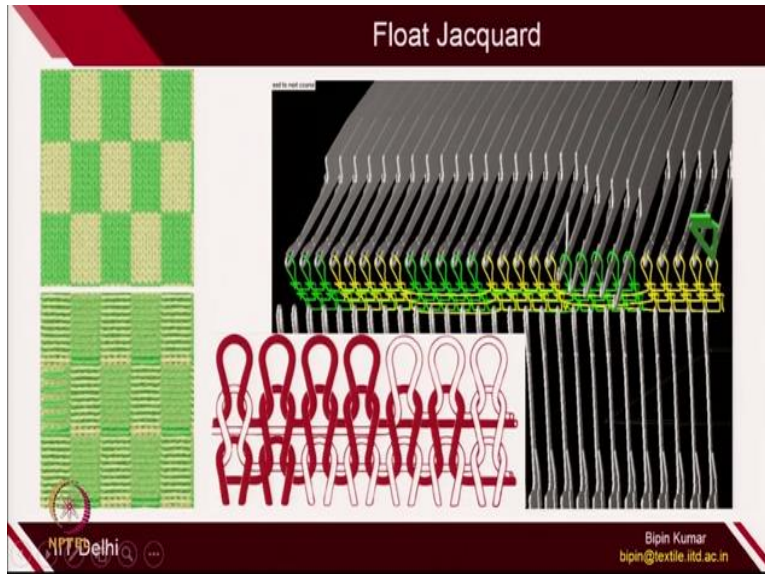
If you see the fabric diagram in the form of loops this is how it looks like. So you can easily see when you are creating these loops. So the red yarn is visible on the surface and here the white yarn is visible and the red yarn is hiding behind the surface on the as a form of float. Similarly, in this course this 3 white yarn is visible in the form of loops and in this 4 columns white yarn is going at the back side in the form of float.

So on the back side you can see this is a straight segment of the yarn which is making float. Similarly, here 4 loops and then 3 floats. So this is called float jacquard okay. Now let's move to the third type of jacquard which is again a float jacquard but we call this as a bird eye.

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Bird Eye Jacquard

Because we need both the beds and the back side instead of looking at the float it looks like kind of bird eye. So I have the fabric sample with me also. First let's look at the fabric sample and then we will give its description.

So this was float jacquard. So on 1 side yarns are visible in the loop form other side in the float form. Here on 1 side yawns are visible on the loop form, other side its having the combination of float as well as back loops. So this is because of which it looks like a bird eye. So and this is the tubular jacquard. So I am putting all types of jacquard in 1 place. So that you get better understanding and differentiation of all 3 types of jacquard.

So this is tubular jacquard which looks both on both sides same. This is tubular jacquard 1 side loop other side float third is bird eye jacquard 1 side loops other side combination of float and back loops. Let me show you on the video also. So in the animation so you can see here this is visible on 5 consecutive green loops are visible and after that this green yarn is making loop and then float, loop and then float on the back bed okay or the front bed you can say it.

Again 5 consecutive green loops after that it is making loop and float on the back bed okay. Similarly, if you follow the pattern of yellow yarn, this 5 is making loops which will be visible on 1 side and rest 5 needle its making loops and float on the back side. So you can see these 2 are

loops and this 1 is float. Similarly, 4 loops and then on the back side loops and float. So this is called bird eye jacquard.

So let's see the animation also so you can see it here. So how it is creating so you can see on the front side both float and loops are being creating okay. So you can see here. So this is how bird eye jacquard will looks.

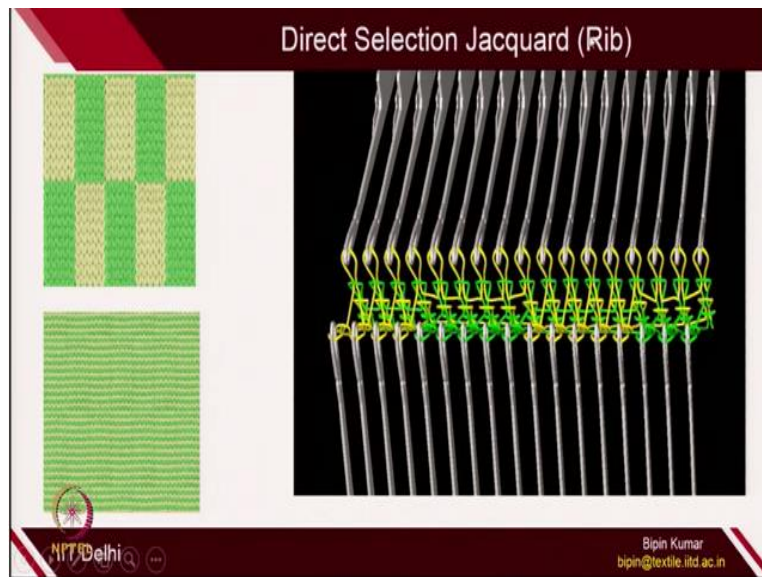**(Refer Slide Time: 48:14)**
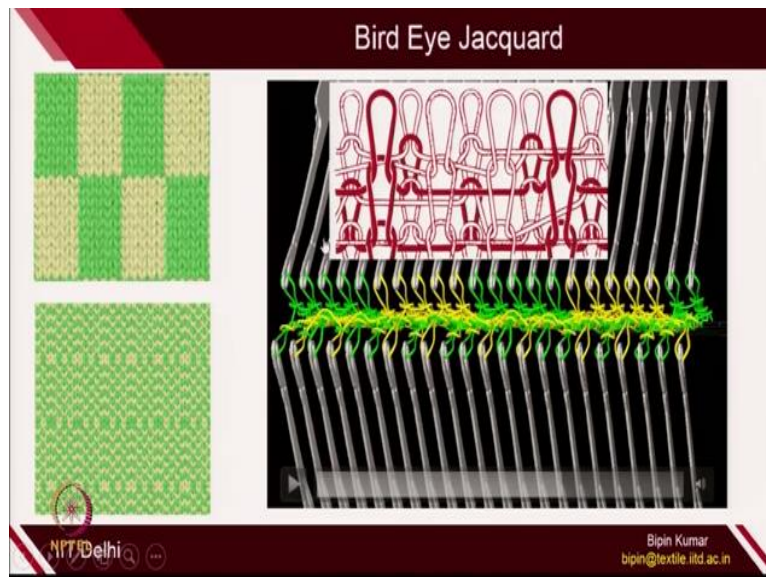
If you see the architecture in the loop form its little bit complicated but I hope you can figure it out what exactly is happening. So let's follow the path of any 1 of the yarn. So if you see this one the red yarn. So I am following the path follow my cursor so if you see here this is making front loops which will be visible after that this is going on the back bed which is making loop and then 3 float because this is the straight segment on the back side.

And then again loop on the back side. So 2 loop and float on the back side and 1 this loop and this loop will be visible on the surface. Similarly, if you follow the pattern of white yarn, so this is the white yarn so you can see here this is on the back side and this front side which will be visible. After that it is making back side which will not be visible then it is making float and then again back side loop.

So to hide the yarn you are using both back bed loops as well as floats. Why we need to create both because if you see the jacquard design if there is a long floats then there could be problem in the operation of the fabrics. Because if there is a long float then there may be chances that whenever a sharp object will come it can catch the yarn. So you do not want to do that. So that's why you always secure those loops on the back side.

So between long floats you are creating some loops so that no sharp object can catch those yarn. Although bird eye is not popular in the industry because its little bit complicated and also the design is not giving any advantage over other designs. It is better than float but definitely not better than tubular. Now let's go to the last part of jacquard which is called rib jacquard.

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So here you are actually using rib architecture to make the appearance of loops on the surface. So let me show you first the rib design.

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So here is your rib jacquard. So this was float jacquard, this was bird eye jacquard, this was tubular jacquard and this is the direct jacquard. So in direct jacquard on the surface the yarns are visible in the form of loops but on the opposite side actually you are creating or hiding in the form of rib structure. So let me show you so on the other side if you see the bird eye so this is bird eye in the form of back loops and floats here only in the form of loops in the form of rib.

So let me show you the animation that will make you more clear but for the time being these are the 4 types of jacquard which is widely popular in the industry. The most unstable one is the float jacket because you can see the yarn can be easily pulled out so this is why the fabric is not stable. The tubular one is really very easy and handy most popular and direct selection jacquard is also quite popular in the industry.

Bird eye is also 1 of the possibilities. So these are the 4 types of jacquard which is being used in the industry. Let's see the animation of direct selection jacquard and then we will finish this particular lecture. So on one side the loops will be visible, the yarns will be visible in the form of loops and the other side you are actually making all loops to hide. So how do we do that so you can see on one side you have yellow loops, then green loops, yellow loops and green loops.

And the other side it is hidden by in the form of rib. So you are creating a rib architecture. You can creating a rib architecture to hide the yarns. So let me show you so first so you created a rib

pattern here. So this both green loops on both the sides and then green loops on the back side then green loops on the both the sides and then back sides and then you are creating again rib and technical front loops for yellow yarn.

Similarly, rib and technical front loops for the green yarn and this is how you keep making the fabric. So you can see it here this side will be visible to you and other side all yellow so you can see all yellow and then all green.

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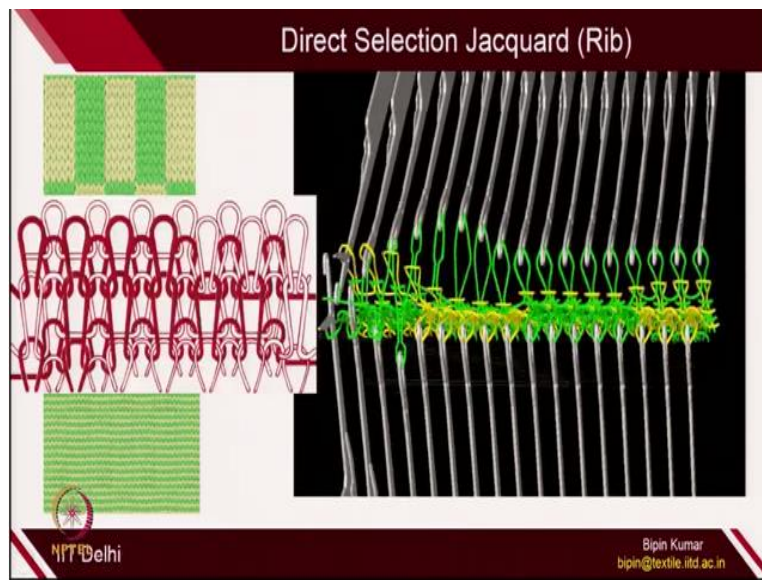
So if you carefully see this architecture, so you can see here so all green line and then yellow lines so these green line and then yellow line on the backside. So basically you are using both rib as well as front loops to make direct selection jacquard. So with this if you want to see the visualization of these type of jacquard you can see it here. So here the red one is on the front side this is visible.

And this one is hidden on the backside then visible, then hidden, visible, hidden, visible, hidden. This is how it is moving and similarly if you see the white yarn this is visible and then you are making one the back side then this is also back side, this is also back side. So this column and this loops will be visible on the front side. Similarly, this red one 1, 2, 3, 4, 4 loops will be visible on the front side by red yarn and then 1, 2, and 3 loops will be visible by white yarn on the surface.

So this is how we create direction selection jacquard. So now you can imagine how complicated is knitting. Definitely you need to have understanding of everything you also need to understand the technology, you also need to understand the science of loop formation and also you need to expert in the designing to actually visualize and make use of knitting either for designing or for engineering its entirely up to the users decision.

So with this we are ending the designing aspect of the knitting. I hope after having so many examples you can now whenever you see any design of weft knitted structure you at least you can guess what might be happening in the fabric structure. So if you can think I think that is more than sufficient and obviously if you do more and more practice more and more reading more and more practicals you can be an expert in knitting as well.

So with this I am ending here and I catch you in the next class where I will introduce you design software to do wonderful knitting. Thank you very much for that.