Science and Technology of Weft and Warp Knitting
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Module - 4
Lecture - 18
Knitting Notations

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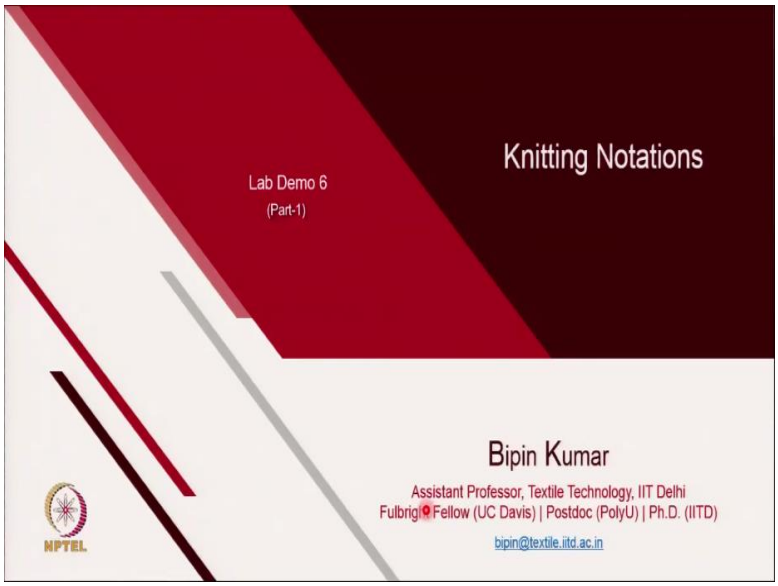

Welcome participants. This is actually lab demo where we are going to learn knitting notation. So, in past few weeks and even in last lecture, you have learned different knitting technologies, different machines, single bed, double bed machines. In last 2 lecture, you also learned about what are the different structure platform especially in single jersey, where you create plain fabrics.

In double jersey, you create rib, purl and interlock fabrics. Last lecture, you learned about how you control the stitches. So, effectively, you can create a number of fabric designs in knitting. So, it is very, very important that you should learn how you can note down these fabric structure. Because, you have seen, some of these structures are very difficult to draw it on a paper.

So, we need to learn some notation by which you would be able to represent these type of complicated fabric structure in weft knitting category. So, just quick revision of stitches what we have learned in last class.

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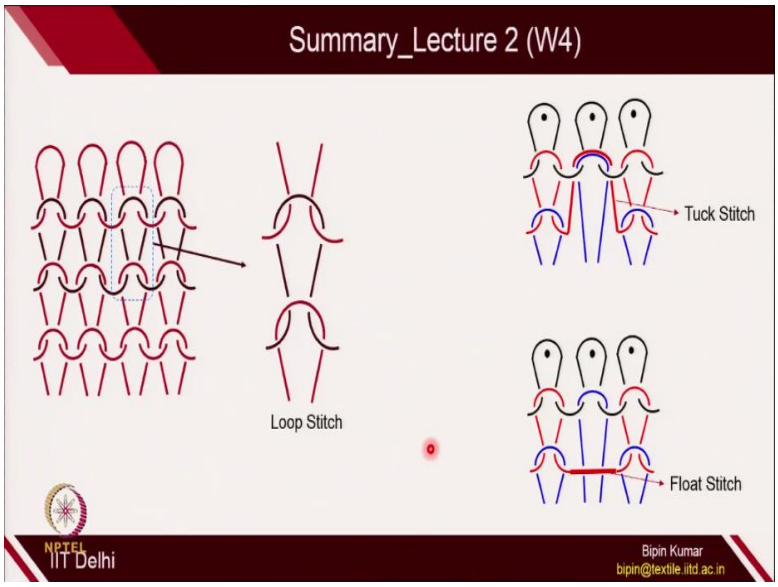

So, in knitting, you can control the number of intermeshing points, especially in case of loop stitches, you need 3 needles loop, where you can create 4 intermeshing points. In tuck stitches, you can see, there are 2 intermeshing points are missing in the loop. Because of that, the fabric behaves differently. And the width of the fabric increases. In case of float, the entire loop by that particular needle is not intermeshing with the bottom loops.

So, how you are intermeshing the stitches inside the fabric structure, that are basically divided into 3 categories: loop stitch, tuck stitch and float stitch. And you can create these type of stitches by playing with the cams which is there in the cam jacket. For example, in case of tuck stitch, if you deactivate the clearing cam, the needle actually do not clears the old loop, but it can catch the new yarn.

And this is how you create tuck stitch. In case of float stitch, you deactivate raising cam. Because of that, it do not clears the old loop; and also, it do not catches the new yarn. And this is how you created the float stitch. You have also seen how tuck and float influence the fabric structure; how it controls the shrinkage; how it controls the width. So, this is how it determines the fabric properties.

But in this particular lecture, we are going to learn about how we denote these type of fabric structure, where you have loop, tuck and float stitches, all present in the same platform of the fabric.

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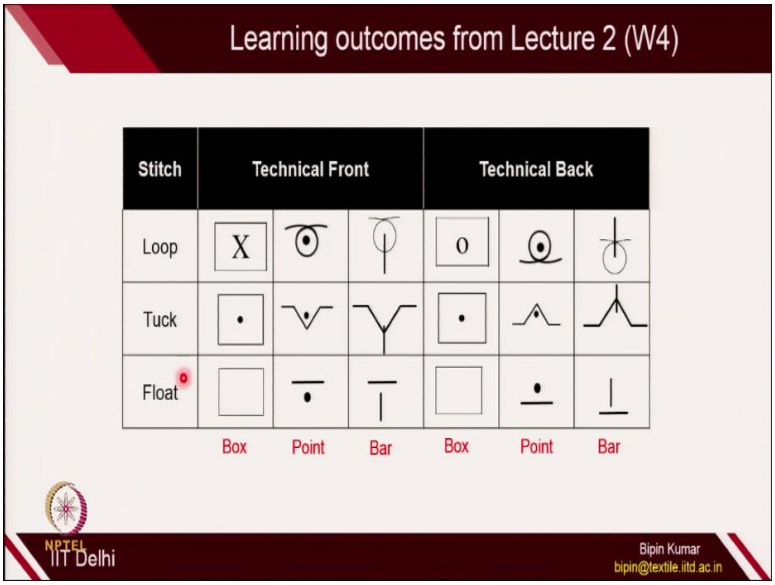

So, before we start, you need to understand the basic notation for these type of stitches. In case of loop, in technical front, you represent by cross. In point and bar notations, this point and bar actually represents the needle. And the line or the curve part actually represents the stitch. Similarly, in technical back side, the loop is represented by 0 in the box. And this is how you represent in point and bar form.

So, point and bar form, you just, if you take the mirror image in vertical plane, you will get the technical back side. Tuck and float also, the representation is like, if you are pointing a point in a box, it represent the tuck. This is how you represent in the point diagram and bar diagram. In case of float also, if you leave the box blank, it represents the float stitch where there is no intermeshing points.

And this is how you represent the point and bar diagram. And for technical front side and technical back side, the representation are different. So, I expect you to at least remember some of these technical details about how you represent the loop, tuck and float stitches. This is very, very important, because when you read any article or even if you go to the market, they use these type of symbols to represent a particular fabric design.

So, in today's class, we are going to learn how you represent a particular fabric design with these type of symbols. And we will selectively cover all the 3 methods: box method, point method and bar method to represent the fabric design.

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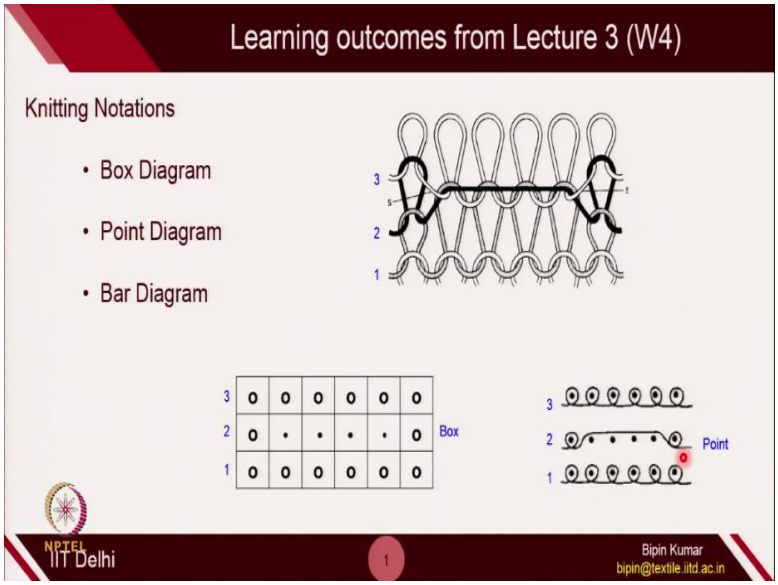

So, overall, in this particular lecture, you are going to learn box, point and bar diagram. You can see the complexities of these fabric structure which is very, very difficult. If you try to draw these type of loops on a plain paper, it is not that simple, because you have to be careful about technical front side and back side, which is extremely difficult when you are drawing this with the pen and pencil.

So, you need to represent these type of complicated structure with simple diagram. For example, if you represent these type of fabric structure, this is the box diagram which actually indicates this design. Similarly, in point diagram, you can represent this fabric structure like this. So, in this particular lecture, we are going to learn the method through which you can convert a actual diagram of fabric into box diagram or point diagram, which is very easy to understand. So, let's move on. What are the steps which is there or which need to be followed when you have to design these type of diagrams.

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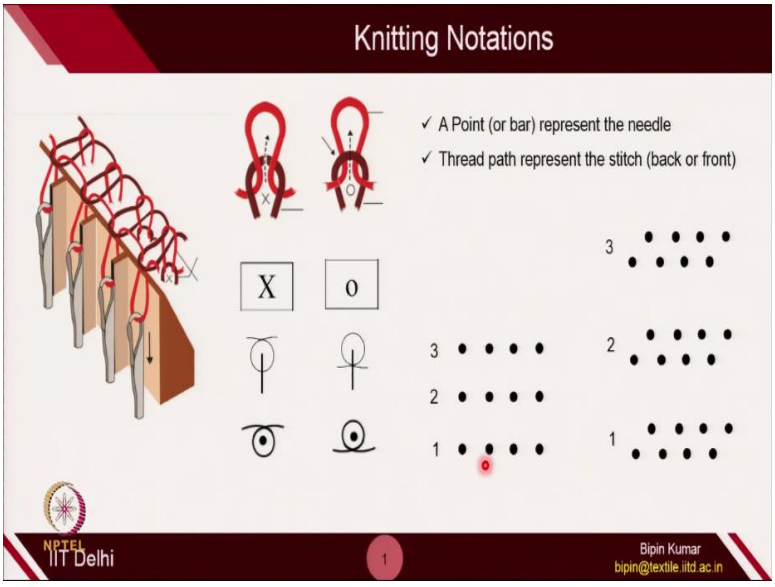

So, knitting notation is extremely important from design point of view, because the number of fabrics which you can create are unlimited in weft knitting. So, these notations will be very, very useful to speed up the process and to make others to understand about the fabric structure. You have already seen technical front side and back side. This is how you represent technical front side.

Especially, if you see the point diagram and bar diagram, they are quite popular in industry. Because, herein, you are actually representing the needles; how many needles has been used; what are the nature of yarn which has been followed. So, a point or bar actually is quite useful, because it is indicating the needles on the machine. And the path which the yarn is following; so, this is the path which the yarn is following. It actually represent a stitch.

And that stitch could be technical front or it could be technical back. For example, if you see, this is technical front. So, the stitch, the yarn is actually moving in this fashion. So, it starts from here, it is going on the back side and then it is coming towards the front side. So, this is how you represent a particular stitch. And that stitch could be float; that stitch could be tuck. So, this is how we can represent this complicated loops by simple bar box and point diagram.

One of the most important thing when you are using needle and point, you are actually able to know what type of beds has been used in making a particular fabric. For example, if you see this particular figure, here 4 needles has been used and there is just 1 bed is represented. So, you can represent these all 4 needles by 4 dots. So, each dot actually represent a needle. So, each dot is actually representing a needle.

And depending on how many times you are traversing the course or how many times you are traversing the cam jacket, you are creating one particular course. So, how many times you are running the cam jacket from left to right or right to left across the machine, in front of the machine, you can represent the number of courses in a fabric structure. So, in the first course, for example, 4 needles has been operated.

So, this represent the first course where the needles are placed in parallel. Similarly, in the second course also; and third course also; and so on. So, depending on how many courses you want to run on the machine, you represent the needles in a sequential order. Similar to the single bed needle arrangement, you have also learned about the needle gating. If you remember, in the needle gating, we have shown you how, in rib machine, even in double bed machine, the needles are not facing each other for the front and back bed.

So, when you are making a fabric on double bed machine, so, you can represent the needle according to the gating of the needles. So, this is how you represent a double bed needles. So, you have front bed, which is shown in the bottom row of the needles. And this is the back bed, so, which is represented on the top side. And these needles are laterally displaced, because we are going to create rib structure.

So, this is how you represent the needles arrangement in a double bed machines. And double bed machines can be V-bed, it could be interlock. So, if you are running multiple courses on double bed machines, you keep continuing these type of arrangements. So, this is how you need to first create the number of needles or select the number of needles which is doing the knitting. And you also have to represent that number of needles for multiple times, depending on how many courses you are going to create.

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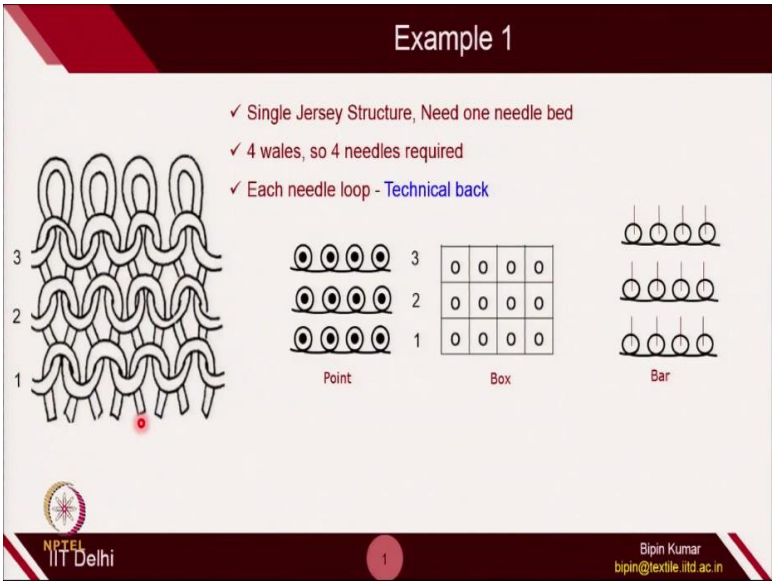

For example, let's see this fabric. So, in this fabric, you can easily see, there are 3 courses. So, which is denoted by 1, 2 and 3. And other thing which you can notice is, all of these loops are being formed on the back side. If you carefully see, this all needles are making the loops on the back sides. For example, if you see the first course, this loop is going on the back side of the bottom loop.

So, this is the bottom loop. And this particular loop is going or being formed on the back side. So, this is technical back. The second loop in that course is also technical back. Third is also same. Fourth is also same. So, naturally if you see, number of column, there is 4. So, 1, 2, 3 and 4. So, these are called wales. So overall, you need to first understand the basic details of the fabric structure.

So, this is a single jersey structure, because all looks like similar. So, we know, to create a single jersey structure, we need 1 needle bed. And the second thing we can also find out is that, you can identify only 4 columns. So, we can say we have selected 4 needles on that bed to create this particular fabric. So, once this is cleared that you need 1 bed or you are creating 4 wales, you can select 4 needles.

So, this is the 4 needles which is representing for this particular fabric structure which is being formed on that particular single bed. So, 4 needles from that single bed, it has been selected. If, let's suppose, if you, it has 50 needles, so you can place 50 dots in a series to represent 50 needles. At present, you have 4 columns, so you are representing 4 needles. After that, you can see each needle loop is making technical back.

Especially, if you see this particular course, all loops are technical back. So, in each of these needles, we have to represent technical back loops. So, this is how you represent technical back. If you remember the symbol, you go back and you see that table, where you can see the technical back is represented in point form in this fashion. Similarly, the first needle is making technical back.

Similarly, if you see, second needle, third needle and fourth needle; these are also making technical back. And you represent this particular course by this symbol. So, first course of this fabric has been represented. And in this, you noted down what are the technical back and front side of the loops. You also noted down how many needles has been used. You also noted down whether it is a single jersey or double jersey structure.

So, this notation, in some sense is very, very useful, because it gives you lot of information about the technologies which has been used, about the nature of fabric surface and also about the width or the number of columns which is being used or made in the fabric structure. So, at present, in the first course, 4 needles, 4 loops. If you go for second course, the nature is same. So, you can represent the second course in this fashion.

If you go for third course, again, they are being formed on the back side. So, third course. So, this is how this entire fabric structure are represented by these symbols. Now, if you go for box diagram, I have already shown you that box diagram, you can represent all the technical back side by 0. So, this is how. There are 4 columns. And each box of this particular table is representing the technical back side, which is represented by 0 or O in the box.

So, this is how you represent the box diagram. In bar diagram, it is quite simple; all the needles by bar. And since it is a technical back side, so, this is how you can represent each of the needles by bar. So, whether you go for point and bar diagrams, it is looks almost similar, the representation almost similar. Some researchers prefer to use this point diagram, some prefer to use bar diagram.

So, do not get confused with this. Basically, they all represent the same nature of the fabric. So, this was the example number 1. If you see this particular fabric, this particular fabric, although it is having only technical back side of the loops on the surface. And you need 1

needle bed. So, it is not needed that this fabric will only be created on a machine which has only 1 bed.

If a machine has 2 beds, then that machine also you can create this fabric structure by selecting 1 bed only. So, in a double bed machines, you can select one of the bed, either front bed or back bed or you can select cylinder bed or only dial bed. So, if you are selecting only 1 bed from a double bed machine, you can still make the fabric.

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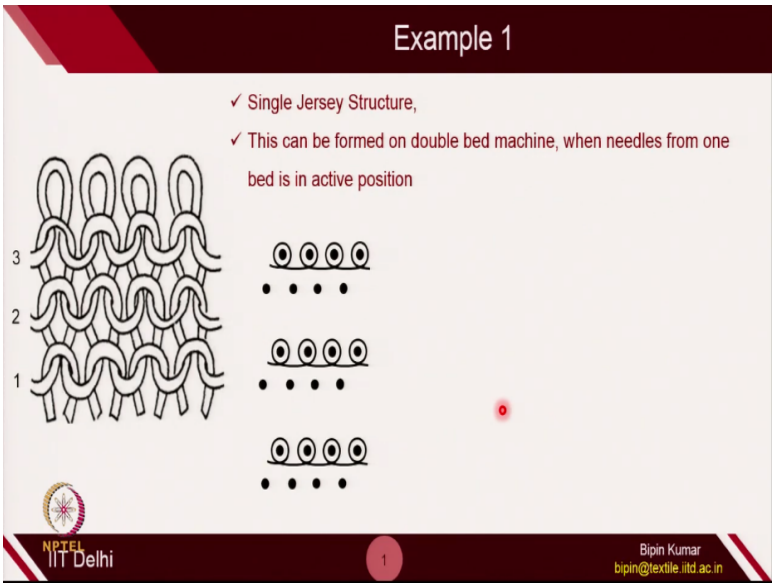

So, in case, if you are selecting double bed machines to create this fabric structure, the notation of needles of that particular machines will follow this fashion. So, you are creating 3 courses. So, this is how the 3 courses has been represented by 3 rows of needles. So, since it is a double bed, so, you need 2 sets of needle: one for front bed, one for back bed. So, this is how you represented this.

And according to the nature of the fabric, you know, the fabric is actually making technical back side. So, if you recollect the previous lecture, you might be knowing that technical back side is produced only by back bed. So, back bed is represented by the top set of needles. So, in each row, the top set is representing back bed and the bottom set representing the front bed. So, in first course, only these needles are making the loops.

The front bed is idle. So, though, the needles on the front bed, they are doing nothing. So, that's how you create single jersey structure on a V-bed machine also or a double bed machine also. So, first course has been formed. This is how you created second course. And

this is how you created third course. So, this is also important. You should be knowing the needle arrangement, because it is very, very important.

In most of the cases, you will notice that only V-bed is quite popular in fabric designs. So, every time you will be noticing 2 sets of needles. And it depends on you, whether you are creating only 1 bed or, in a particular course or you are using both the beds simultaneously. Let's see another example where you have a double jersey structure.

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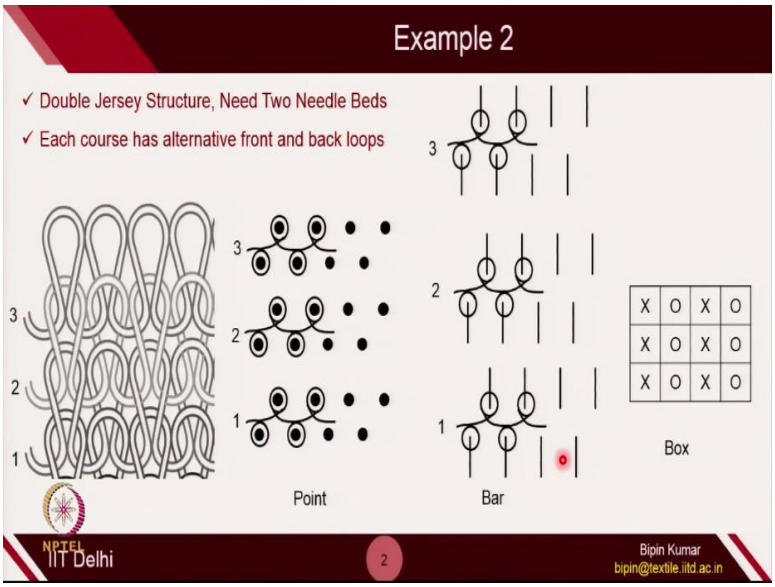

If you carefully see, this is going on the front side and the next loop is going on the back side. And then, the third loop in the column is going on the front side. And then this fourth loop is going on the back side. So, this is naturally a rib structure, where alternating loops are technical front and back along a course. So, once you have technical back and front on a surface, naturally such type of fabric can only be created on a double bed machine.

So, you need 2 double beds. So, there should be no confusion. You need 2 sets of needle: one for front bed, other for back bed. Since here, 3 course are present, so, you represented 3 times the double set needles. And now, we are have to fill the yarn path to represent technical back and front side. So, let's fill the yarn path on the first course. So, this is the first course. And in the first course, you can fill the front needles with technical front loops.

So, this is how here the technical front loops is being formed in front bed needle. And here, the technical back loop is formed on the back bed needles. And these 2 are connected. So, if you still go and check the symbol, this is how you represent technical front and this is how

you represent technical back. And these 2 are connected. So, that's why this part which is the sinker, it is connecting these needles, the loops of these 2 needles.

So, again, you have made the representation of these 2 loops, the first loop and second loop. Now, you are going for third and fourth, it will follow the same. Since here, 4 loops are only present in a course, other needles has, you cannot show those needles because the loops are missing; because only 4 loops are there in the column. So, other needles, you can leave blank. In the second course also, the similar nature. And third course also, similar nature.

So, 4 wales are representing 2 wales on the front side 2 wales on the back side. So, this is how you represent this particular fabric structure. If you want to go for the minimum design, like if you want to really represent this fabric by, even in simplest terms; so, if you just represent this particular 1 course, it is actually repeating all the time. So, this is the minimum design of the fabrics to make this fabric on a double bed machine.

If you go for bar diagram, again the same thing. You have the front bed needles and back bed needles. Front bed needles are making loop like this. Back bed needles are making loop like this. So, this is the normal notation of technical front and technical back in a weft knitting notation. So, again the second course, similar; third course, similar. In box diagram, it will even simpler, because we have already seen this; so, cross, 0, cross, 0.

So naturally, if you see the utility of point and bar diagrams, they are much more informative. Because, it is giving you the gating information; how the needles are arranged; which bed is operating under which conditions; whether it is operating only in first course or second course. Otherwise, in box diagram, all those informations are missing. So, this 2 diagram, point diagram and bar diagram are the most popular one from design point of view. These are the basic examples. You have seen some of the complicated fabric structure in weft knitting.

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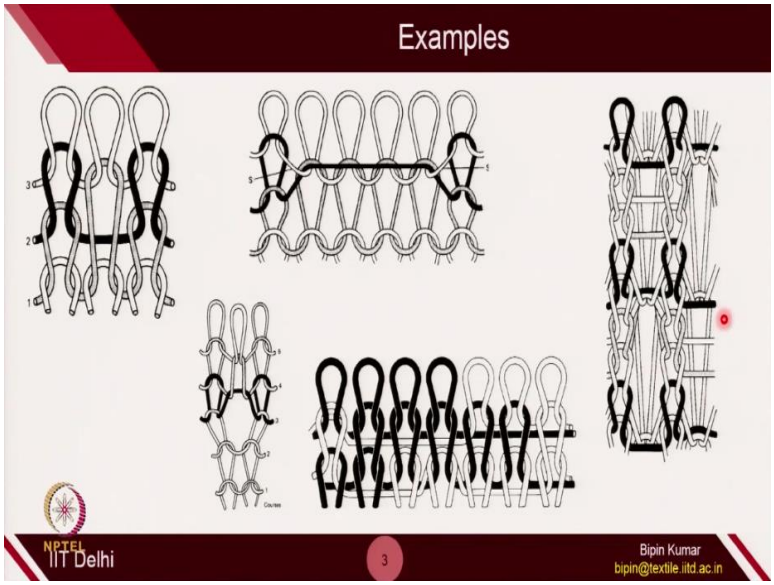

So, these are the, some of the complicated designs which can be there in weft knitting machines. And if you know to note down the fabric notation for these type of complicated structure, it will be a wonderful thing for you. Because, this will make such designs look simpler, if you understand the concepts. So, now I am going to demonstrate you, by how you can create the notation for each of these fabric structures.

So, stay tuned. So, let's see how we approach to make designs for these type of complicated structures. **(Video Starts: 21:21)** Before we start, once again, I am saying you, you need to learn all of these symbols. We can follow any one of these symbols for representing that fabric. So, let's see the first fabric which I am having is; let's see the first fabric. So, this is the fabric, you can see.

So, to represent this particular fabric, we have to follow the certain steps. So, first of all, you should be knowing well which machines you are using. If you cannot identify the machine, at least you should be knowing whether it is a single jersey fabric or double jersey fabric. So, if you see the nature of loops; so, this loop is technical front, this loop is also technical front, this loop is also technical front.

Now, if you see this loop, this loop is also technical front; this loop is also technical front; this loop is actually the float, the black one, which is going on the back side. Again, if you see this one, technical front; this one, technical front; this one, technical front. So naturally, if you see all of these 3 columns, the nature of the needle movement is almost same. So, this

fabric can be created on a single bed machines, because the nature of loop formation is all technical front.

Although, this loop is float, where the needle is not catching the yarn. So, once you know it is a technical front loops, so, you can definitely say, identify the technologies which should be used in for this type of fabric formation. So, it is a single jersey fabric and is created by 1 set of needles. So, now, how many needles you can see here? So, each column actually represent 1 needles.

So, this is 1 needle. These, all loops are created by second needle. These, all loops are created by third needles. So, you have 3 needles which has been used. So, these are the 3 needles. Now, you should identify how many courses you can see. So, how many times you have used these needles. So, if you carefully follow, this is the first course, okay; the second course, the yarn path; if you simply follow the yarn path, you would be able to know which one is doing which course.

This is the third yarn path, third course. So, these needles has been used 3 times. So, first course, second course, third course. So, these are the 3 times it has been used. Now, if you see the first needle, it is actually making. This loop is technical front side. So, how do you represent technical front on this particular needle. So, if you carefully see the symbol, this is how you represent technical front loops. Okay.

Loop, technical front, this is how you represent. So, you can simply represent like this. Okay. Now, if you see this one, this loop looks much, much bigger. So, if you carefully understand the last lecture where I have shown you the held loop, in case of tuck formation and float formations. So, you can easily say this loop is actually a held loop. This is again a loop, because it has 4 intermeshing points: 1, 2, 3 and 4.

So, again this is a loop. And this is being formed on the front side. So, these legs are coming on the front sides. So, this one is also making front. And since these 2 loops are connected, so you can simply connect the dots. Okay. So, you can see, this yarn path has not broken. So, this loop is actually connected with this held loop which is the bigger one. This is how you connect it.

Again, if you see the third loop of the first course in the third column, again this is technical front. So, this is how you represent. So, the first course has been represented by 3 technical front loops. Okay. Now, you move to the second course, which is the interesting one. So, in second course, if you see the first loop in the first column; this is technical front, so no confusion.

But if you see this one, here the yarn is in straight form. It certainly indicates that this yarn has not been catched by the needle. So, it is actually a float. So, which is shown in the back side. So, if you recollect the previous lecture, this float is actually visible on the technical back side. But on front side, only the held loop is visible. The float is shown in the behind of the fabric. And how you represent a float in technical front side?

So, this is how you represent. So, float in technical front side, it, on the top side of the needles, you can simply present a bar. So here, on the top side of the needle, you simply present a bar. Okay. So, now, these, if you see this fabric, this is technical front and then float. And these yarn is still connected. So, you can connect the yarn. So, you have simply connected the yarn. Now, if you see this one, this is again simple, technical front.

So, you go and do like this. So, this is second course. Now you, if you see the third course, this is the third course, all technical front. And this first and third are almost similar. So, this should not be a problem. All loops are technical front. This is how you represent in point form. So, this is point notation. Okay. If you want to go for back side, if you want to go for bar diagram, you can simply do that.

You can simply do the bar diagram. So, in the bar diagram, so 3 bars are, is represent. Each bar is representing 3 needles, 1, 2, and 3 courses. And you can, you can simply represent the loops on each of the bar. Simply, if you can project these needles, these 2 are almost similar. So, this is the bar diagram. So, if you see the bar diagram, so this is how technical front loop looks. So, if you see here, so this is the bar and this is how you represent a loop in a technical front position.

This is how you represent the bar diagram. The most simplest one is the box diagram. So, if you go for box diagram; so naturally, you need 3 columns and 3 rows. So, 1, 2, 3; 1, 2, and 3. So, 1, 2, and 3. So, all 3 are technical front; so, all 3 are technical front. So, cross, cross,

cross. If you see second course, this one is technical front, then float. So, float is represented by blank box. So, you do not have to fill anything here; cross, cross, cross, cross.

So, let's see how we represent float in technical front side. So, this is the blank box. So, this is how you represent float. So, it depends on you, which one you actually want to follow. Each of these notation point, box and bar has its own utility. So, I expect you to at least follow one of these method. If you understand any one, you would be able to describe other's notation as well.

Now, let's move to the second example where you have tuck stitches. So, here again, if you want to represent, you have to first understand whether it is a single bed fabric or double bed fabric; or it is a single jersey fabric or double jersey fabric. So, you see the nature of the loop first. So, if you see this first course, all loops are technical front side. It means, all needles are doing the same operation.

So, naturally, this fabric is being formed on, by your single bed. So, that's why it is a single jersey fabric. Now, the stitches has been different. So, if you see the first courses, all stitches has 4 intermeshing points. If you see the bigger loop also, 4 intermeshing points. If you see this loop also, 4 intermeshing points. But in second course, 4 intermeshing points. But if you see this one, it has only 2 intermeshing points.

The foot is not present. So, this is nothing but the tuck. So, this black one is nothing but the tuck. So, we have different notation for tuck. Again, this loop is having 4 intermeshing points. Top loops has 4 intermeshing, I am missing the last one, but at least you know, this is technical front side loops. So, in the first course, 3 needles has been selected and this fabric has single bed nature.

So, that's why we represent first 3 needles for first course. And this, there are 3 course which is visible for the fabric. So, you simply extend these needle set 3 times; second, third. Okay. Now, we start filling the loops in this needles. So, this is technical front side; you fill it very easily. This is all technical front side, very simple. Now, the second course. This is technical front side.

You create a technical front side. But, if you see this one, this particular loop in the second course is tuck. And how do we actually represent tuck. So, what is the tuck notation? So tuck, if you see, in technical front side, you have to project the yarn path below the needles. Okay. So, you have to represent the yarn path like this. Okay. So, you have gone below the needles. So, since this loop and tuck are connected, so that's why, you have to simply connect these dots. Okay.

So, front loop is connected with tuck. After that, again, like this. Because, after that you have again technical front loops. So, this is how you create it. So, you better be careful, because handwriting is extremely important here. But if you carefully design, you can get a very beautiful notation out of it. Now, if you see the third course, all are technical front. So, its very, very simple; all 3 technical front.

So, this is the point notation. Now, if you go for bar notation. So, you need 3 sets of bar. First course, second course, third course; first, second, third. So, in each of these, each bar represent 1 needle. So, to represent technical front, you make this notation. So, if you see here, this is how you note the technical front in, for the loop. This is again a loop. So, all 3 loops. And these all are connected.

So, this is how you have made the technical front. Now we go for the second course, again same; 2 has been formed. But if you see technical front for tuck representation, we represent like this. So, almost similar nature. This is how you represent. Okay. The third course, again all loops. You simply follow all loops. Okay. So, this is how you represent bar diagram. Now, the last part, which is the box diagram, you simply make box; 3 courses, 3 columns.

So, first, second, third. So, first box, all loops are technical front: cross, cross, cross. In second course, the first one, this one is technical front; then this is technical front tuck side. So, how do you represent in a box form? The tuck is represented by a dot. So, this is the dot. So, you represent dot, because this is a tuck loop. Then, the third loop, technical front. Then, 1, 2, 3; in the third course, all are technical front loops; cross, cross, cross.

So, this is the box diagram. So, this is how you can represent. You don't have to draw the actual movement of yarn, because it is extremely difficult if you do it by hand. And you would not be able to draw technical front and back side. So, that's why these type of

notations become extremely useful. So, this is the second example. **(Video Ends: 36:20)** So, thank you. Thank you very much for listening.