Science and Technology of Weft and Warp Knitting

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Lecture - 34
Design Software

Welcome participants. This is the last lecture in weft knitting category. So, this lecture, I am going to introduce you design software. So, in knitting, in the last lecture, you might have seen so many complicated design of the fabric. How do we make that? That is the fundamental question. So, are you keep doing hit and trial on the machines or is there any other techniques where you can actually simulate the fabric formation before knitting.

So, design software is that beautiful thing which happens in the knitting industries where before doing hit and trial on the machine, which is a very cumbersome process, you can create your pattern on the design software, do the simulation, learn the knitting and then you can go and make the fabric in practice. So, there are 2 companies in the world; one is Stoll and Shima Seiki.

So, the design software from Shima Seiki has been introduced here in this particular lecture. So, in our lab also we have one machine from Shima Seiki and we got this design software from the industry and I am very-very thankful to them for designing such a wonderful software, which helps you to learn knitting to a next level. So, let's see what exactly this software does.

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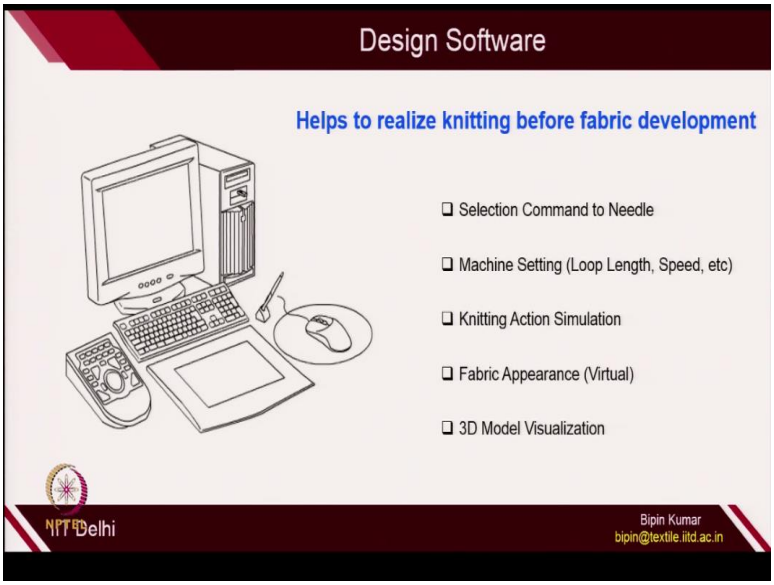

So, if you see this design software, it is actually very powerful to help you in realizing the knitting action before fabric development. So, this is a big advancement in knitting because in real practice whenever we make any design, we have no idea of how the fabric surface will look. So, if you keep making different, different designs on the machines, you will be wasting a lot of yarn and the samples during this process.

So, that's why before you make any design or any pattern, if there is a mechanism through which you can realize the fabric, you can see it, you can see the knitting action, then that will be really useful in doing the hit and trial and without wasting lot of yarns on the machine. So, design software is actually design in such a way that helps you to give command to the needle, you can actually give the command to the needle like what needle should be doing.

So, because on the machine there 1000 needles, so you can decide on the computer like which needle should be doing what, you can also decide the machine setting like you can also set the machine parameter with the help of design software itself, whether you want to go for higher loop length, whether you want to go for speed, whether you want to catch the feeder for left side or right side.

So, all those things, you can give the command using design software. Also, you can learn the knitting action simulations. So, you might have seen lot of animation videos where I have shown you how the needles are catching yarn and making loop, tuck, float, cable, pointelle, all those sort of things. So, you can, all those simulation is actually collected from design

software. So, thanks to Shima Seiki for making such a beautiful animations of bed where you can actually realize the movement of needle.

So, all those simulations also you can see for any pattern design, also virtually you can check the fabric appearance. So, if you have a spun yarn, you can check how the fabric surface will look for a particular pattern, you can any time change the color of the yarn to look at the surface, you can also do the 3-D model visualization. So, once you make the fabric, you can use a 3-D model where you can wear that, the model can wear that fabric in virtually and you can look how the fabric will look on a three-dimensional shape.

So, it is a complete package, before doing or wasting any yarn, you can actually realize the structure of fabric on a 3-D virtual model. So, this is the beauty of design software. So, I thought maybe I should introduce you this wonderful aspect of design software and each of these aspects, I am going to cover it step-by-step and I will give you 1 or 2 examples on how you can create whatever designs you want simply on the machines.

And once the machine says okay, you can go on the real knitting machine, which handles these type of software command and you can make the actual fabrics.

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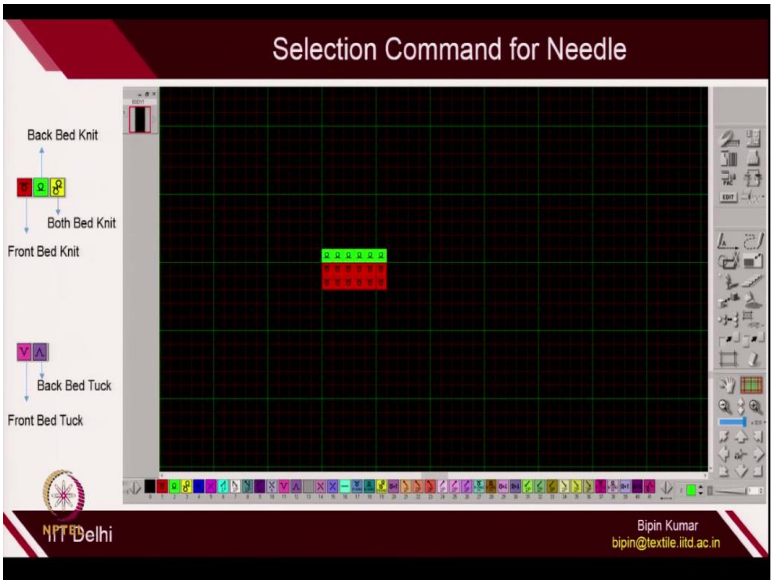

So, let's see the selection command for the needle. So, on the design software, when you open the design software, it will give you a window and on this window you can see a matrix of boxes. So, each box actually represents 1 needle on the front bed okay. So, this box if you

see, there are like 1000 boxes in this window and each box actually represent the needle and if you see at the bottom, so if you see there are different colors options are there.

So, each color option actually indicates what action you want to achieve. So, for example, here I have selected 6 needles and I have given command number 1 and command number 2. So, this is command number 1 which is the red box and green box is command number 2. So, what does this command indicates? So, out of this window, I have selected only 6 boxes and these 6 boxes actually it is nothing but the 6 needles on the front bed.

So, in this particular course, I have chosen 6 needles on the front bed and I have given the command number 1 which is the red one. In the second course also, we have chosen the same 6 needles and we are given command number 1 which is the red box and in the third course, we have again used 6 different needles because on the back bed. So, this is how the command has been changed in the same column okay.

So, let's see what these each of these box commands mean. So, whenever you feel any of these black box with red color, which is the 1 number which is shown here, this indicates front bed knit okay. When you fill any box in this window with command 2, which is the green box, it indicates that the needle at that location should be making back bed knit so back loops. If you give command number 3, it means both the needles should be used on the front bed and back bed.

This is the command actually you are giving to needles of the machine. So, if just like a jacquard selection, individual needle selection, so any needles on any course can be given any command depending on your choice. So, each of these box if you see one row, it represent one course and each box you can choose which represent what needle action should be performed on the machine.

Similarly, if you want to go for other commands, there are almost 250 knitting actions, which is possible for each boxes and each knitting action has different role to play in the loop structure. So, you can imagine how complicated a design can be made. So, for example, here I have chosen box number 11 and 12. So, 11 is a purple one, so this is the purple ones. So, when you give this command to any particular box, that needle will make choose the front bed needle and it will make the tuck at that location.

Similarly, when you choose the purple one, this one which means it will choose the back bed needle and make the tuck and there are lot of line commands and there are some other tools which helps you to make the design and pattern. If you want to write your name, you can simply choose some of these tools and you can create your name and that can be done in the process.

So, design software first of all whenever you have any pattern design in your mind, you open the design software, open the window, you choose how many needles you want to operate and you start imagining at what course, what needle should be doing what. So, all those things you can fill it individually, that takes time, it will again depends on your imagination and your understanding about the knitting and that you can do it on a design software.

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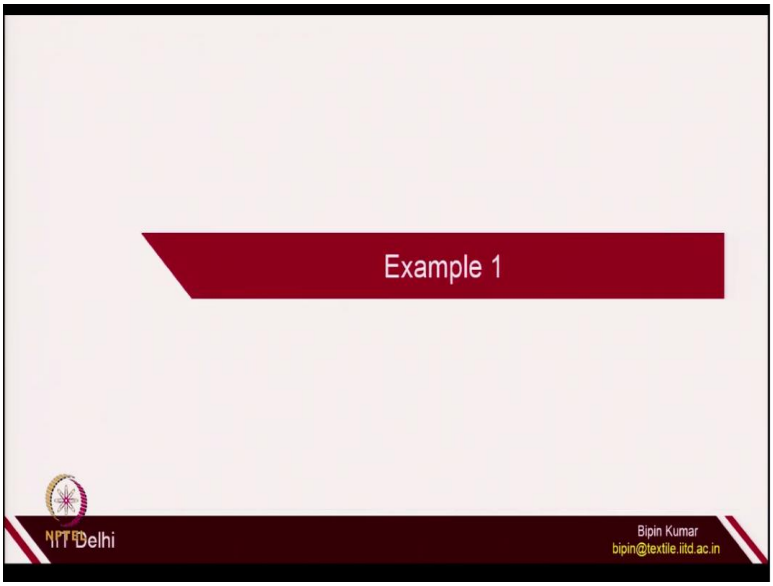

So, let's see some of the examples. Then, I hope you will understand this. Honestly speaking, you need at least 6 months of training to run this design software. Practically, in 1 or 2 lectures I might not be able to introduce you the design software in the deep because I cannot bring the design software here. I just take out 1 or 3 examples and I will show you how design software works and how powerful it is.

Because using the designs software, you are not actually doing knitting, you are just simulating everything, the whole environment is being simulated and you are making the fabric in virtual form and once you are satisfied, you can go and run the machine and make the fabrics. So, let's see a simple example.

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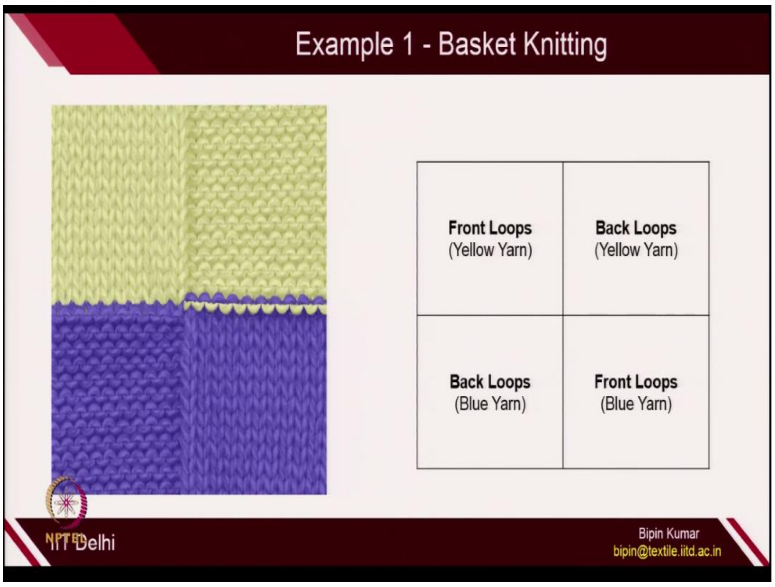

For example, let suppose if I want to create a basket knitting, I hope in the lecture number 2 in this week, I introduced you link design where front and back loops are connected in the same course. So, let suppose if I want to make a basket knitting and this is the actual fabric. So, here you can see this is the technical back loops and this is technical front loops. This is again technical front loops; this is again technical back loops.

So, multiple loops of technical back and technical front are present. So, one interesting thing you can also observe is the color of the yarn. So, up to certain courses, you are using blue yarn and after that you are using yellow yarn, so this is here. So, blue loops, back loops and front loops up to this much courses are being created with the blue yarn and front loops and back loops in the next courses are made by yellow yarn.

So, you are changing your loops also in the same course and you are also changing the color of the yarn after certain courses. So, this is what you want to achieve on the machine. So, how do we actually make it? So, once from the design, if the design is clear in your mind that you want to place back loops and if you want to place front loops, if you know how the loops will look like, you can choose how many back loops and front loops you want to place with each other.

So, that again depends on the user. Let suppose I select 16 to 18 back loops, 16 courses of back loops and 16 columns of back loops in this block and again 16 cross 16, 256 loops of front loops and here also 16 cross 16 and here also 16 cross 16, just the perfect symmetry.

Definitely, it again depends on the user, you can go up to any loops, any number of loops you want. Let's see how we proceed.

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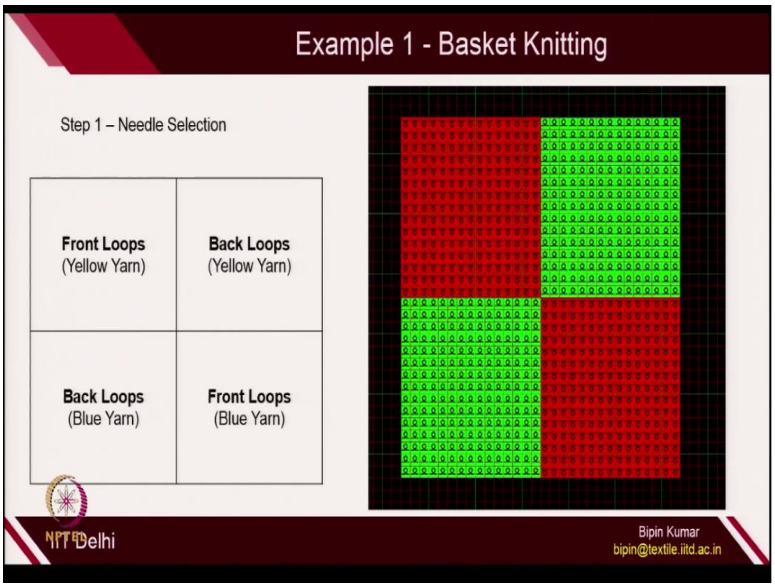

So, the first step in the design software is you open the window, so you can see each box actually represent a needle and at this moment, we have not given any command because all the boxes has color zero, which is the black color. So, if the needle has not been selected, then that will be a resting position of the needle and needle will not do any knitting action. It is just like if you remember on the single bed and V-bed machines, we were having acting positions and non-acting position.

So, it is just like when there is a black box in the window, it means there is no knitting action. So, we need to first create back loops and front loops. We already know that the red one indicates the front loops and green one indicates the back loops. So, what we can do is I am showing you the video also. This is how you created back loops and front loops okay. So, this is back loops.

The green each green box represent one back loops and here each red box represent front loops so okay. So, naturally if you want to create this back loops, obviously back bed needles will be used and if you want to create front loops, obviously the front bed needles will be used and this is how you created the pattern depending on your imagination okay. Once this is done, here only you have selected the needle but the bed when you go for knitting, the machine does not know like up to this portion you need to use the blue yarn.

After that for this much number of courses, you have to use yellow yarn. So, you have to give command to the machine that which feeder you need to use for which number of course.

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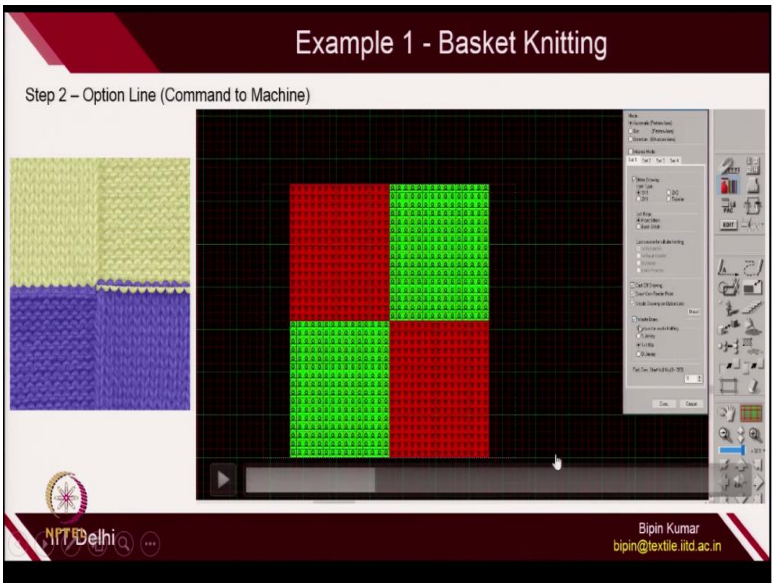

So, that is called option line. So, once the pattern is ready, you create options, command for the machine using design software because certain courses you are using blue yarns and certain courses you are using yellow yarns and the machine does not know, so obviously you need to give the command to the machine. So, this is the animation. So, here you have the option line options, which give commands to the machine.

So, one thing the machine also wants to do certain things by themselves. What do you mean by that is like whenever you make any pattern, the extra provision is given in the form of waste because you have seen how fragile is the edges, so the machine always make certain courses before starting this pattern that is called waste and certain courses on both the sides that is called hem.

So, it is actually hem and waste are always created by the machine because you actually do not want to lose the main pattern area. So, that's why you give, the machine actually creates additional few courses of waste and hem.

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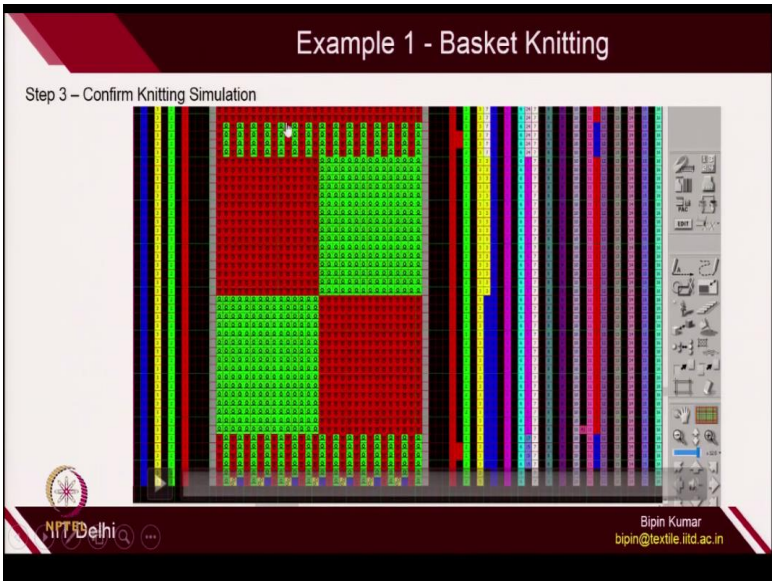

So, this is the main area and some area it is created for waste and hem. So, this is the hem part, starting part and this is the waste part. So, each of these option lines, you have to give command like what machine should be doing. For example, the command could be what could be the stitch density like how much pulling of the yarn should be done, which color of the yarn should be used, which side the carrier should be catching the yarn, left side of the machine or right side. So, all these are the option lines.

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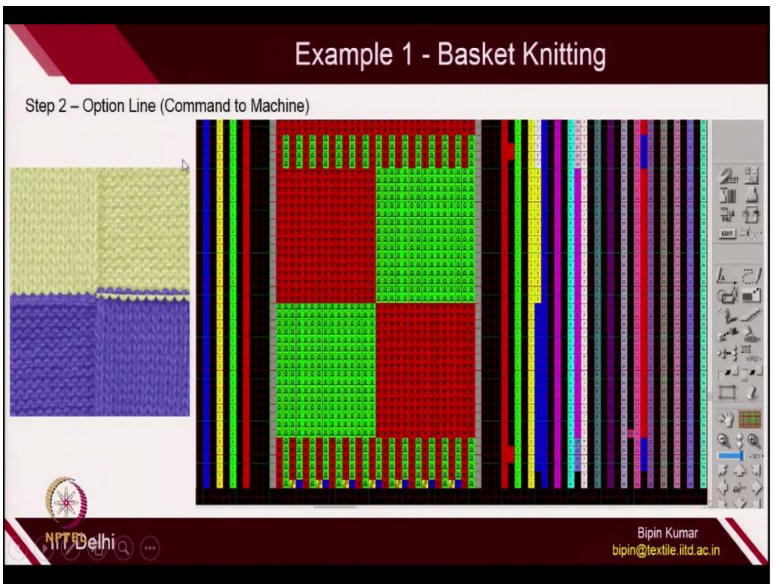

So, since we have to give options of like here you use blue yarn and in this much courses, you use yellow yarn, so I am going to give those commands here. So, let's see here itself, so the option lines has been here, so now up to this much courses, I want yellow yarn to be catched. For that started filling, so you can see I am giving the command that you use yellow yarn, so the colors code I am giving to the machine.

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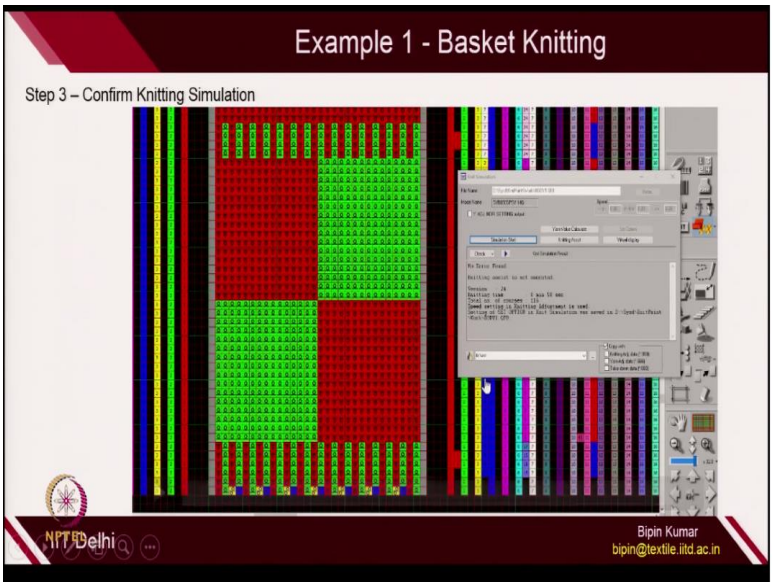

So, once the option line has been given, then you can go for simulation. So, now you need to confirm with the software that whatever commands which we are giving, is it okay before we go for knitting because if any command is wrong, the software itself will tell you like there is something wrong and you need to do the rectifications. So, obviously before you do the knitting, so here is the simulation command where you can simulate and you are confirming whether everything is okay, yes or no.

So, you execute here. So, now here you can do the simulation. So, you can read here. There is no error found. So, once there is no error found, it means that this design is ready to go, you can you can feed the program to the machine and the machine will make this pattern. So, this is the beauty of design software.

If you want to learn the knitting action because on the machine, it is very difficult which needle is doing what because that is practically impossible to observe in the running state of the machine. So, that's why design software gives you the options that you can for each courses, you can see the knitting action.

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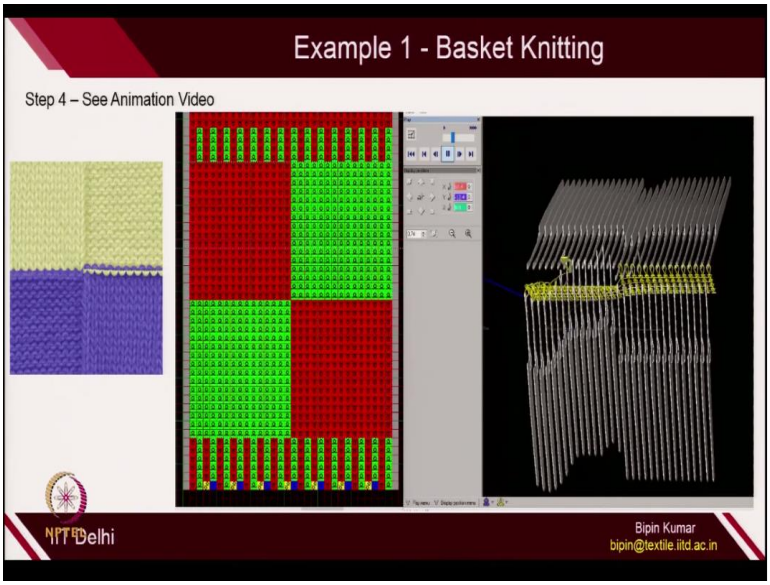

So, you can see the animation of how the needles are acting with the help of command, simulation command. So, here if you click on this, it will show you, it will open a new window for you and it will show you all the needles of both the beds. So, this is front bed, this is the back bed and I want to see what is happening in this area because this is what I wanted to create.

So, you can see here the blue yarns has been catched by both the beds, so here back bed and then front bed. So, the first course is being formed, so you can observe course wise, so each course so like right now the third course is moving on which is happening here. So, course wise you can see what exactly is happening on the, so you can see here, this front bed is acting, the backward is not acting.

Here, backward is acting, front bed is not acting. So, this is what options you have given here from right to left. So, you can keep doing it for each number of courses okay. So, this is exactly what is happening. Now, let's we want to see whether it is catching yellow yarn or not. So, we need to wait till this much course it completes. So, I am skipping this part, let's move to this point, so it first taken the blue yarn up to here.

After that, it is catching the yellow yarn, you can see. So, because we have given the command here and that's why it is now catching yellow yarn. So, this is how options lines. So, here is the option lines which is giving that command to the machine to use different feeder okay.

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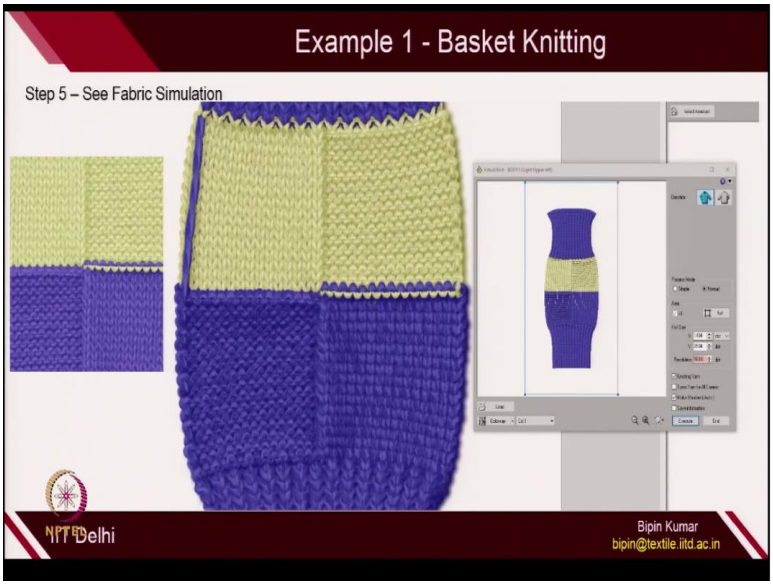

The other things also you can also see the fabric, how it will looks like, so that option is also there. So, virtual display, so it will make the fabric and you can see how the fabric looks before even making the fabric on the machine. So, this is the virtual simulation of the fabric, you can see it here, you can zoom it out, you can make any dpi and you can check the colors also and this is actually the fabric will look like once it has been formed on the fabric.

And you can extend it, you can carefully see, you can enlarge any loops, any portion and this is how the fabric will look like when you use 2 different colors and give that command on the machine. So, this is the power of design software, so you can imagine any design, any color, you can do it, you can simulate it before knitting.

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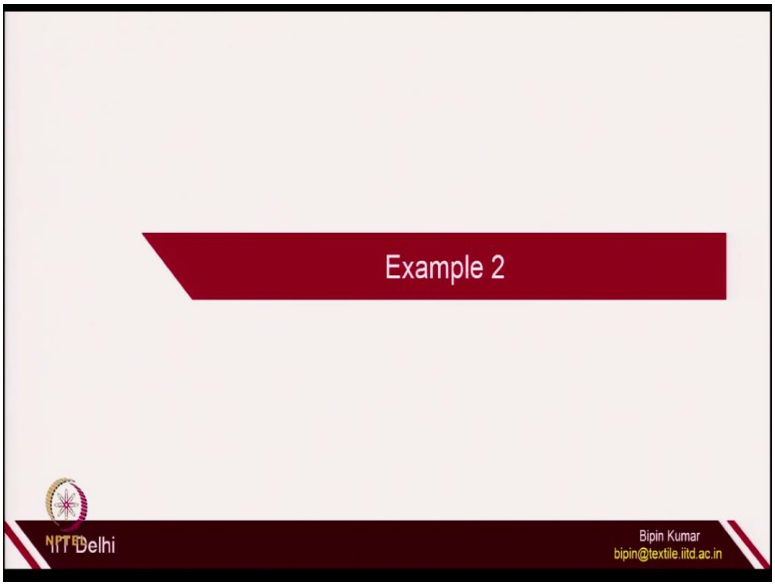

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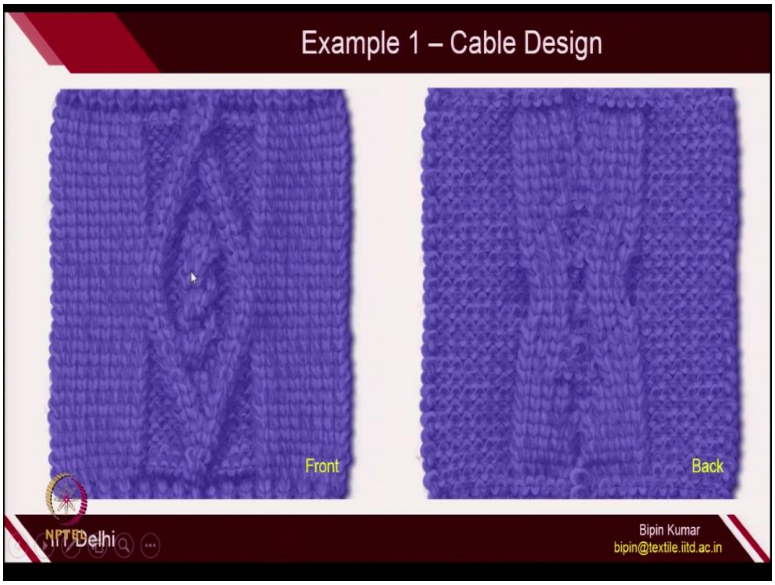

Let's move to the another one, little bit complicated but I am not going step-by-step but I will just show you the demonstration. So, let suppose I want to make this cable and aran design. So, you can see this is the cable and this is 2 cables is happening from outer side and it is also changing the direction and from inner side also. On the backside, it looks like this.

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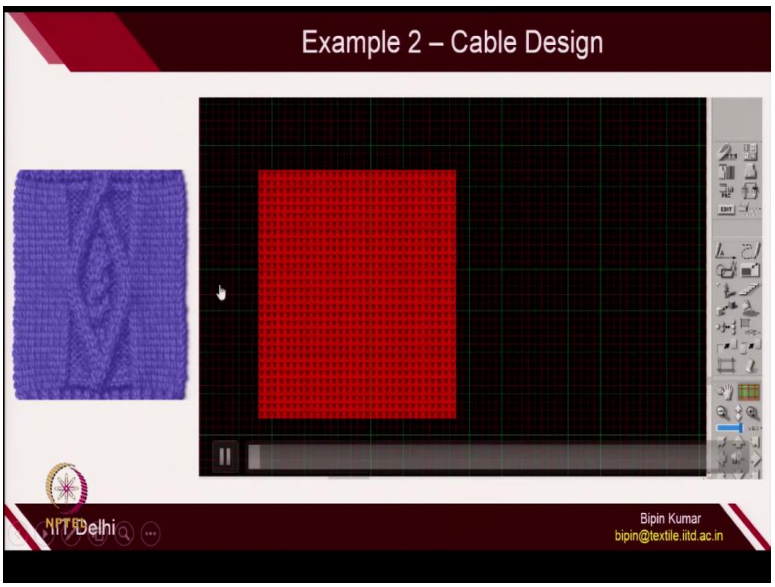

So, how do we actually make it? So, if you want to make this cable, here is the entire video. It is run for 2 to 3 minutes and you will realize how we actually make these fabrics. Obviously, first you have to give the command, it depends on your understanding on the knitting, which 2 needles you want to switch, swap or how you want to change the directions. So, it entirely depends on how well you have understood the knitting so far.

Let’s see the animation. So, first you started the box, all black bed and then you need to give commands for these cables. So, this is the command for cables.

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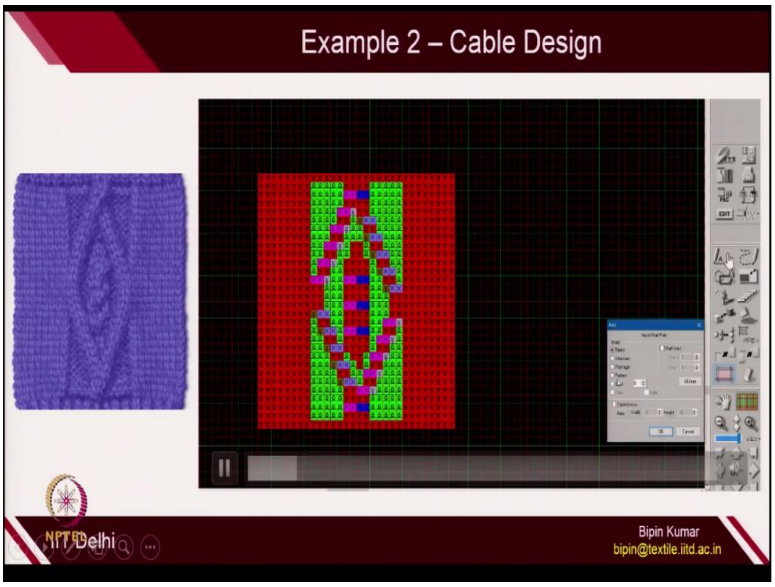

I am not going to the individual box size, again it is just, you can imagine it just have the function of racking, loop transfer, back bed, tuck, float. So, all those functions, some functions has been used here. Especially, for making this type of designs, we use racking, we use transfer, we use front loops and we use back loops. No tuck and no float has been used in making this particular design.

So, once this is done, you can go for option line. You can give the option command. Since the color is same, so no need to worry and you can simply go for simulation here.

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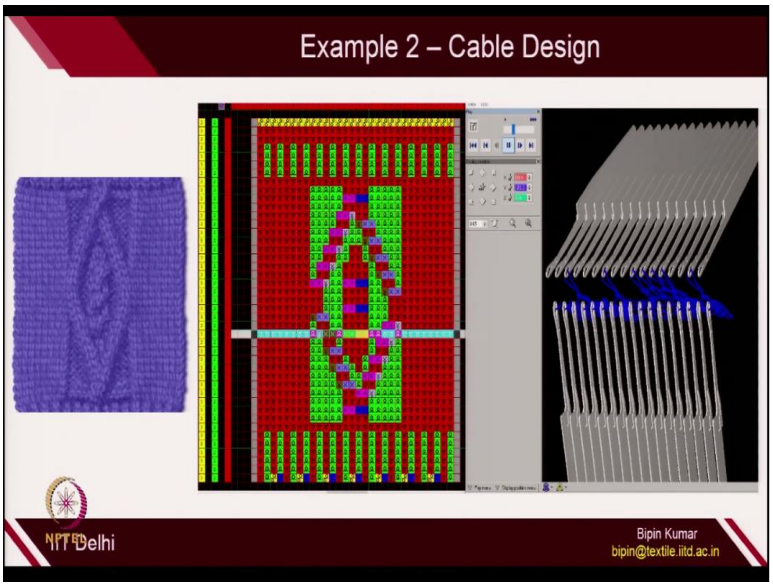

So, you can see the knitting simulation. Window will come out and for each course; you can see what which needle is doing what. So, that is more important and I can select only this much portion of the needle for knitting actions, so I just selected on this portion and this is where you can see the window, you can zoom it, you can see at this moment. In this particular, this much needle is making front bed, which is shown here.

This is the front bed and then you made one course, then you are making. So, if you carefully see this 5 green loops, it means 5 back bed loops have been used and another 5 back bed loops which is being formed here okay. So, you can see it here. So, the first course all loops, in second course you are making front and back both, then now the transfer starts happening because here the cable has to be interchanged.

So, you can see here, so at this especially here, you have given the command to the columns to swap and this is what the needles is doing. So, with the help of racking and transfer, the 2 columns are swapping each other okay. So and this way now from here you are giving command that every alternating course, the columns will be shifted and by 1 pitch. So, in this way, you are changing the direction in 2 different directions; 1 direction and 2 directions.

And after few courses, you are swapping here also, you are making another cable, so which is here. So, this is again the command which is given for swapping the columns okay. So, this is how you create this complicated design. So, all those knitting simulation was possible because of design software. So, naturally if you want to go more in deep, you need to do the practice more and more with such type of software.

Obviously, learning this software itself needs at least 6 months to 1 year but if the basic concept and the science of loop formation remain same. This only the other commands which is there in the software that you need to learn very carefully because each command on the software is having different roles to play and if you miss any commands, the whole knitting cannot be done, so you need to be very careful while you making any program on the design software.

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So, with this you can imagine any designs you can possibly create and simulate on the design software and if you are comfortable, you can change the color, you can change the aesthetics, you can change the pattern and once you confirm that everything is okay, you can feed that program in a pen drive and you can go to the machine and you can make the fabric out of it. So, with this I am ending the weft knitting portion of this lecture series.

I hope you like this weft knitting. Again, knitting will have no meaning if you do not practice in your lab because knitting is entirely depends on how much practical you can do it. So, if you have any machine of knitting in your university or in your company, I request you to please go and make some fabric sample, try to understand the action, try to understand the engineering aspect, try to analyze the fabrics so that you can learn more and more about knitting.

You can also follow their n number of literatures from different journals, different resources from the internet and hopefully with the help of your basic understanding about knitting you can catch any knit structure and any technologies, which you will come in future. So, with this thank you very much for listening to the weft knitting section. From next week, we are going to move to the new section of the knitting, which is warp knitting.

Warp knitting is much more complicated compared to weft knitting. So, stay tuned, we will complete that segment also. Thank you very much for your understanding. Thank you.