

Subject: Knitting Design Technology

Unit 1: Basic flatbed knitting

Quadrant 1 – E-text

Learning Objectives

The learning objectives of this unit are to:

- Differentiate woven and knitted fabrics.
- Classify knitting into various categories.
- Attain knowledge in flat knits in general.
- List various basic fabric structures.

1.1 Introduction

Knitting or Knits, what comes to your mind?

T shirts, Sweaters, socks, glowses, cap, may be foundation garments too. Shirts, Trousers, Kurta, etc. are generally wovens.

So What is Knitting and how is it different from Weaving.

Woven fabric is made up of interlacing of yarn. Knitted fabric is created by interloping of yarn. Weaving require two sets of Yarns namely warp and weft. For Knitting, only one set of yarn is required. Either weft yarn or warp yarn. The first classification of Knits are based on whether you use weft yarn or warp yarn. If you use weft yarn then it may be called as weft knitting and if you use warp yarn then it may be called as warp knitting.

1.2 Basic Characteristics of Knitted Fabrics

Stretch is the most noticeable characteristics of knitted fabric. Stretch is achieved with non-stretchable yarn. So, how does the stretch happen with a non-stretchable yarn and why if the same yarn is used for weaving, the fabric become non-stretchable. In weaving first, the yarn on both weft and warp direction are already stretched and then interlaced. The same yarn is used to created loops. The loops can be stretched both horizontally and vertically till it straightens up. This gives the stretch to knitted fabric. You can notice one more thing, stretch in horizontal direction is much more than the vertical direction.

The name Latch needles comes from the latch which can be closed or open freely. The hook pulls the yarn from yarn feeder and creates the loop. The latch will automatically open when the

needle goes up as the loop inside the hook slides down through the stem of the needle. If the needle pushed upwards enough, the loop will be cleared of the latch. Now when the needle comes down, the latch will be closed by the loop on the needle and loop slips off from the needle.

Interlooping of Yarns

Once the needle moves up, a yarn feeder will provide yarn to the hook of the needle. At the same time, the existing loop on the needle would have moved down beyond the latch. When the needle moves down, the hook draws yarn from the feeder to create a new loop. At the same time, the existing loop will slip over the new loop and create an interlocking structure. When a row of needles moves up and then down one after the other, a row of knitted loops is created.

So it is understood that if a knitting needle moves up and down and if there is a feeder available to feed the yarn when the needle goes up, knitting may happen. The movement of the needle is made possible by movement of the cam box or carriage over the needle bed.

A needle bed is a metallic slab with grooves for the needle to be placed facing up. The butt of the needle would be protruding out of the needle bed while the rest of the needle would be inside the groove. By pushing the butt up or down you can control the movement of the needle. The cam box consists of a few cams which have groove shaped in such a way that if the cam box moves over the needle bed, the butt of the needle will enter the cam groove and the groove will guide the needle up and down.

The cam box also carries a yarn feeder which will feed the yarn whenever the needle comes up creating new knitted loops.

Needle movement for knitting with a diagram explaining the upward and downward movement of needles to create a knit stitch.

1.3 Course and Wale

When the machine creates multiple rows of interlocked loops, a knitted fabric is formed. A closer look at the knitted fabric will give a clear idea about how these loops are interlocked. The row and column of loops would be very clear. The row of loops are called course and the column of loops are called wale.

To increase the length of a knitted fabric the number of courses to be increased and to increase the width of a knitted fabric number of wales to be increased.

1.4 Basic Types of Knitting

As explained, either warp yarns or weft yarns can be used for knitting, the classification starts from the same difference.

If warp yarns are used then it is called warp knitting and if weft yarns are used it is called weft knitting. In other words if loops are produced vertically, then it is called warp knitting and if loops are made horizontally then it is called weft knitting.

Warp Knitting

Laces, mesh fabrics, fine fabrics used for lingerie and thick fabrics used for outerwear are the most popular fabrics made out of warp knitting.

Weft Knitting

Most commonly used knitted garments such as T shirts and Sweaters are made out of Weft Knitting. The most popular weft knitting machines are divided based on the shape of the needle bed. Based on the shape of the bed the machines are classified as Flat V shaped needle bed machines and circular needle bed machines.

Flat and Circular Knitting

When the Flat V shaped needle bed machines (in short, Flat Knitting) produces mostly flat fabrics, the Circular needle bed machines (in short, Circular Knitting) produce tube shaped fabrics. The Flat Knitting machines produces courser fabrics and circular knit machines produces finer fabrics. The most commonly found sweaters are knitted in Flat knit Machines and the most commonly found T shirts are knitted in circular knit machines.

Since we are concentrating in Flat Knitting, it will be interesting to start with the name itself. The reason for Flat V Bed Knitting is because of the arrangement of two flat needles beds in inverted V position which make a right angle at the top of the needle beds.

The needle beds are arranged in such a way that the grooves of opposite beds are not opposite to each other. When the needles from both the beds go up simultaneously, the needles would be staggered to have space between them to accommodate needles from opposite bed.

Gauge

The number of needles available in one inch of the needle bed is defined as the gauge of the knitting machine. A machine with 5 gauge (5gg) would be producing a thicker fabric compared to a machine with 10 gg.

The most common machine gauges are 2.5gg, 4gg, 5gg, 7gg, 8gg, 10gg, 12gg, 14gg, 16gg, 18gg, 20gg, 22gg, 24gg, 25gg, 28gg, 30gg, etc. Today there are machines available with 80gg too!

Most of the Flat knitting machines are below 20 gg and most of the circular knitting machines are above 20 gg. Though technically it is possible to produce circular knitting machines with courses gauges like 7 or 5, it is not popular in the knitting industry for a variety of reasons.

The flat knitting machine needles used in advanced machines have an additional latch on the side of the needle which helps in transfer of loops (this would be covered in detail in the following sessions).

This additional latch prevents the needle manufacturing technology to produce gauge finer than 20. In future there may be a way to produce finer flat knitting needle as the demand for flat knitted garments is ever increasing.

Basic Structures in Flat Bed Knitting

There are three basic stitches in Flat Knitting. A full loop called Knit, a half loop called Tuck and no loop called Miss.

Knit

To produce a Knit stitch, the needle has to go all the way up so that the loop inside the needle hook is cleared of latch area and the new loop would be taken through the previous loop.

Tuck

To produce a Tuck stitch, the needle has to go only half way just enough to catch the yarn from the feeder at the same time, the loop inside the hook will slip down over the latch but will not clear the latch. When the needle comes down, the previous loop will return to the hook and the hook will also have the new half loop. Since the new loop has not passed through the previous loop, it cannot be called as a full loop hence the half loop.

Miss

To produce a Miss stitch, the needle should not go up at all. The needle misses the knitting and produces no loop and hence a Miss stitch.

The Cam Box

To produce all these three types of loops, the cam box should be set accordingly. The cam box has a groove which can be altered to get all three basic stitches. For Knit, keep all cams in position and the groove will guide needles all the way up to form the stitch.

For Tuck stitch, Switch on the tuck cam (essentially withdraw the tuck cam) the groove will be altered and the needle will raise only half way and come back creating tuck stitch.

For Miss, switch on the raising cam, (withdraw the cam) and this will allow the needle to pass through the cam box without pushing the needle upward resulting a miss stitch.

Stitch Size

There is one more cam which is called as stitch cam. This can move up or down which will alter the length of a stitch.

If the cam is set lower, the needle, after receiving yarn on hook will come down more than usual and result a larger stitch.

If the stitch cam is set at a higher level, the needle will come down little less than usual forming a smaller stitch. For example, A 7 gauge machine with a smaller stitch can produce a fabric which looks like a 9 gg and the same machine with a larger stitch can produce a fabric which looks like a 5 gg.

1.5 Basic Fabric Design

If you see a fabric with V shape stitches on one side and horizontal streaks on the other side, you may be looking at a Single Jersey. The Single Jersey is produced by engaging needles from one bed of the machine. Either front or back bed can be used for producing single jersey. We have to disable one needle bed to produce single jersey. This can be achieved by closing the levers in cam box.

Double Jersey

If you see prominent V shape formation on both the side and it looks identical, you may be looking at a double jersey fabric. A double jersey can be illustrated as a sandwich of two single jerseys back to back. Double jersey is produced by engaging needles from both the beds simultaneously. Since, we are engaging both needle beds in knitting, there is no need to close any of the cams.

Combinations of Knit and Miss

Some of the basic fabric structures are produced by combining Knit and Miss Stitches and they are called Milano structures. Since the presence of Miss Stitch restricts the stretchability of the fabric, it is ideal for parts of garments where stiffness is required. For **Example:** The collar of a Polo Shirt.

There are 4 types of Milano Structures and they are:

Half Milano, Alternating Half Milano, Milano Rib, Rib Ripple.

Half Milano

In the Half Milano structure, A course of full needle knit on both the beds followed by a single bed knit completes the Half Milano structure.

Alternating Half Milano

In the Alternating Half Milano structure, A course of full needle knit on both the beds and a back bed knit followed by another course of knit on both the beds and a front bed knit is repeated to create the fabrics. This is like Half Milano repeated two times with single bed being reversed from back to front in the second repeat.

Milano Rib

In the Milano Rib structure, A course of full needle knit on both the beds and a back bed knit followed by another course of front bed knit completes the structure. Since, three courses complete the repeat, we have to show 2 repeat units, in the cam notation. Rib Ripple

Rib Ripple

In the Rib Ripple structure, A course of full needle knit on both the beds and 2 courses off back bed knit completes the structure.

Combinations of Knit and Tuck

Some other basic fabric structures are produced by combining Knit and Tuck stitches and they are called Cardigan structures. Since the presence of Tuck stitch double up the loops on a single hook, these structures create bulkiness into the knitted structure and also increases its stretchability.

Cardigan Structures

There are 6 types of Cardigan structures and they are as follows:

Half cardigan, Cardigan, Double Half Cardigan, Double Cardigan, Half Cardigan Double Sided, Rippled Cardigan.

Half Cardigan

To produce Half Cardigan, start with a course of full needle knit on both the beds followed by a full knit on front bed and full tuck on back bed, to complete the structure.

Cardigan

To produce Cardigan, start with a course of full front knit and full back tuck followed by another course of full front tuck and a full back knit to complete the structure.

Double Half Cardigan

As the name suggests, double half cardigan resembles half cardigan. To produce double half cardigan, start with two courses of front and back knit, is followed by 2 courses of front knit and back tuck to complete the structure.

Double Cardigan

As the name suggests, double cardigan resembles cardigan. To produce double cardigan, start with two courses of front knit and back tuck, followed by 2 courses of front tuck and back knit to complete the structure.

Half Cardigan Double Sided

Half cardigan double sided, is just a reverse of the second repeat of half cardigan. To produce half cardigan double sided, start with a course of front and back knit, followed by a course of front knit and back tuck. Now, start again with a course of front and back knit followed by a course of front tuck back knit.

Rippled Cardigan

Ripple cardigan is very similar to the construction of Rib Ripple. To produce Ripple Cardigan, start with front and back knit, followed by 3 courses of front knit and back tuck.

Transferring of Loops

Transferring of loops from one needle to another makes the Flat Bed Knitting all the more preferred way of making garments these days. Shifting a loop from one needle to another on the same bed is known as Move. Shifting of needles from one bed to needles of another bed is known as Transfer. On hand driven low tech machines, transfer and move is achieved by a transfer tool. The machine operator uses this tool to pick up the stitch to be shifted and put it into the desired needle to create the pattern.

Designs Using Move And Transfer

A variety of designs and patterns can be achieved through the transfer and move techniques.

Pointelle Designs

Pointelle designs are achieved by Move technique. The desired loops of a single jersey fabric is moved toward the right or left side on the same needle bed. This creates an empty needle and leaves a hole in the fabric. These holes can be arranged in such a way to create the desired pattern.

Drop Needle Designs

A Drop Needle Design structure is usually created by switching off few needles. Before switching off the needles the existing loops has to be shifted either with move or transfer techniques. This will create a rib pattern and a variety of designs can be achieved.

Transfer Patterns

To create transfer patterns, transfer few loops to the opposite bed, continue knitting for few more courses, and then again transfer back and continue knitting.

Cable Design

Cable pattern is one of the most popular structure which uses the drop needle design as well as move in a particular way.

First, create an identifiable wale cluster by giving back knit on either side of the cluster. This will make the cluster to stand out as shown in the image.

Now, divide the wale cluster into two and cross the loops.

Racking

Racking is achieved by relative movement of one bed against the other on sideways. This will shift the loops of one bed in relation to the loops of the other bed. This makes the wale to deflect towards right or left. To show the real effect of racking, a Rib structure with drop needle is used. The front stitch will then move towards right or left over the back knit and a zigzag pattern will emerge.

Wale Deflection

Wale deflection is achieved with a technique similar to the cable pattern. In cable pattern we exchange the front knit loops by crossing and placing it in each other's position. In Wale deflection, we exchange a set of front loops and a set of back loops by crossing and placing it in each other's position. This will create a pattern where the wale gets deflected either toward right or left, creating a pattern.

Tubular Fabric

Though the Flat Bed Knitting machine is known to make flat fabric, it is capable of producing a tubular fabric as well, if we use a combination of Miss and Knit. While going to one direction, knit on one bed and while coming back, knit on the opposite bed to create a tubular structure. This technique also allows one to produce a single jersey fabric with double the width of the needle bed.

1.6 Conclusion

To summarize, in this unit you have been given an overview of knitting and been familiarized with fabric variations that are possible in flat knitting.