Chapter 9
Knit Fabrics & Their Properties

Objectives

Knitting

- The formation of a fabric by inter-looping of one or more yarn sets.
- Industry: knitted yard goods and knitted apparel

Quick process
- 4 times faster than weaving
- Made on wider machines
- Versatile process
- Yarns must be much more regular; filament, combed, or worsted

Knit Characteristics

- Requires More yarn than woven fabrics.
- Fabric: Porous, bulky, lofty, warm, wrinkle resistant, low in cover, permeable, stretchy; may run (collapse of a wale).
- Uses: Apparel, furnishings, & industrial goods.

Quality and performance assessment:
- Similar to woven fabrics, but snagging and skew can be major problems.
- Better quality knits have good weight for fabric type, are well suited for end use, free of defects, and have good performance potential.

Knit Fabrics
**Methods**
- **Filling** or **weft knitting**: yarn moves horizontally (back and forth) or around the fabric.
- **Warp knitting**: yarn moves vertically in the fabric.
- **Needles**: spring-beard, latch, or compound.
- **Stitches**: loops made by needles (also known as loops).

**Wales**: Vertical column of stitches; each needle forms a wale; **wpi** is wales per inch.

**Course**: Horizontal row of stitches; one row of wales; **cpi** is courses per inch; **wpi X cpi** describes fabric density.

**Cut or gauge**: Number of needles per inch (related to stitches per inch); higher the number, finer the knit.

**Technical face**: Better finish; more expensive and finer yarns; least snaggable floats; pronounced design; may not be fashion side (filling pile and imitation purl knits).

**Environmental impact:**
- Less than for weaving
- Less use of chemicals to prepare yarns
- No equivalent of water or air jet looms
- Quieter than shuttle looms
- Less lint
- Less energy use

**Machine knitting steps**: Loop pulling, running, clearing, yarn feeding, knock-over.

**Types**: Hand or machine.

**Machine types**: Flat bed or circular.
**Knit Stitch**

- Basic stitch of majority of fabrics
- Technical face (top) and technical back (bottom) of jersey

**Jersey (Made with Tape Yarns)**

**Intarsia**

- Old stitch stays on needle in forming new stitch; thicker, wider, less likely to elongate than knit stitch.
- Creates pattern in fabric.

**Tuck Stitch**

- Yarn floats across wale; narrower, thinner, and less likely to elongate than knit stitch.
- Create design using different color or texture yarns.

**Float or Miss Stitch**

**Jacquard Jersey**
Purl or Reverse Stitch

- Looks the same front and back, like the technical back of knit stitch.
- Seldom used, expensive to produce; technical back of knit stitch creates identical look for lower cost.

Single Filling Knits

- Machine uses one set of needles.
- Usually circular type:
  - Flat bed machines: Wide fabrics or shape product parts.

Single Filling Knits

- Pile knit jersey: Cut or uncut pile with two yarn sets (bulk continuous filament (BCF) and other); knit, heat set; BCF yarn shrinks, other yarn forms pile.

Single Filling Knits

- Sliver knit jersey or fake fur: Yarns form ground and sliver forms pile.

Single Filling Knits

- Weft insertion jersey, French terry, fleece: Large, novelty, or irregular yarns laid in courses for texture, weight, or appearance; brushed or unbrushed.

Single Filling Knits

- Full fashioning:
  - Shaping garment parts by adding or decreasing wales via loop transfer; done at necklines, armholes, collar points, usually in jersey; expensive; slow.
  - Looping: Joining shoulder and sleeves of shaped parts to look like continuous knitting; avoids appearance of seams; more expensive and slower.
  - Hosiery

Shaping While Knitting
True Full Fashioned  Mock Full Fashioned

Fashioning Garment Pieces

- Made with two sets of needles; may use two sets of yarns
- **Gaiting**: arrangements of needles
  - **Rib gait**: needles on one bed opposite space on other needle bed; both beds knit simultaneously
    - **Rib knits**: simplest type is 1 X 1 rib; same appearance face and back; twice as extensible and thick as jersey; does not curl; runs or unravels from end last

Double Filling Knits

- Either gait
  - **Purl**: loops pulled to face on one course and back on next course; both sides look like technical back of jersey; highly extensible; does not curl; runs; unravels from either end; slow process
  - **LaCoste**: alternating tuck and knit stitches create mesh-like fabric
  - **Double knits**: two or more yarn sets create pattern
  - **Jacquard double knit**: each needle controlled by microprocessor to create structural designs

Double Filling Knits

- **Gaiting (cont.)**
  - **Interlock**: simplest fabric; two 1 X 1 ribs interlocked; both sides look like jersey; does not curl or run; unravels from one end only
    - **Interlock gaiting**: needles line up across beds; knitting must be synchronized

Double Filling Knits

- **Pique (LaCoste)**

Simple Double Knit (left), Jacquard Double Knit Face (center), **back** (right)
Making fabric using one or more yarn sets where each set is controlled by guide bars and each stitch is formed by different yarns.

- **Gauge:** Needles per inch.

**Warp Knitting**

- Fast method.
- Requires very regular yarns.
- More stable (like wovens), but flexible like filling knits.
- Less resilient and lighter weight compared to filling knits.
- Stable in both directions.
- Number of guide bars indicates number of yarn sets and fabric name (e.g., two bar tricot).
- **Point paper diagram:** Each point shows a needle in a course; each row shows a different course.

**Characteristics of Warp Knits**

- **Machines:** Tricot and Raschel.
  - **Tricot:** Uses one or more sets of yarns that are wound on warp beams and mounted on the knitting machine.
    - Often filament yarns in finer gauge; tricot (plain, brushed, etc); lock stitch or lock knit does not run, but may "zip" along a wale; outwear, underwear, tulle.

**Warp Knit Machines**

- **Raschel:** Use one or two sets of vertically mounted latch needles.
  - Often spun yarns in coarser gauge in elaborate or complex pattern; lace, furnishings, industrial uses, & outerwear.
  - **Insertion warp knits:** Usually a raschel type.

**Warp Knit Fabrics**

- **Warp Knit Stitch** (Point Paper Notation)
  - Tricot
  - Raschel:
    - Use one or two sets of vertically mounted latch needles.
    - Often spun yarns in coarser gauge in elaborate or complex pattern; lace, furnishings, industrial uses, & outerwear.
    - **Insertion warp knits:** Usually a raschel type.
Comparison of Filling & Warp Knits

- Minor warp knits
  - **Simplex**: uses spring-beard needles, two needle bars, and two guide bars.
  - **Milanese**: yarns move diagonally in fabric
- **Narrow knitted fabrics**: either filling or warp knit; elastics, trims, hook-loop fasteners

Other Warp Knits

- Knits have one yarn looped through itself or through another yarn.
  - They take more yarn than wovens, but are much faster to manufacture
  - They are stretchy, lofty, and generally warmer than wovens
- Knits are created in the weft or filling direction (horizontal) or in the warp direction (vertical)
- Stitches in the vertical direction are called wales.
- Stitches in the horizontal direction are called courses.
- Filling or weft knits are created on flat beds or circular machines
- Jersey is the most common weft knit. It can be light weight to heavy.
  - It is a plain weft knit.
- **Intarsia** is a decorative form of knitting that inserts a yarn for only the length of the design (as opposed to carrying all the way across the back of the fabric)
- The tuck stitch is a decorative stitch that creates a skip in the vertical direction (creating 3-dimensional pattern)
- The miss stitch or float is a decorative stitch that creates a skip in the horizontal direction (creating 3-dimensional pattern)
- Jacquard jersey uses variations of the float and tuck stitches on the reverse side to create pattern with colored yarns.
  - The purl stitch uses the back side of the knit as the face
  - Full fashioning means to create the shape of the garment on the machine as it is knit; instead of knitting a length of fabric, cutting out a pattern and stitching it together.
  - Double knits are created with two knit beds interlocked together
  - The rib knit alternates a knit stitch with a purl stitch to create a 3-dimensional ribbed effect. This is often found on hems, cuffs and necklines of sweaters.
  - Interlock is a thicker and more durable knit

Summary

- Pique or Lacoste is the type of knit you most commonly see on polo shirts
- Double knits look like they have the same face on both sides
  - Jacquard double knits create a colored pattern on the front and hide the yarn within the knit on the backside
- Warp knits are often not as stretchy as weft knits, but they can be lighter weight and serve different purposes
  - Tricot is commonly used for undies, fake fur, draperies, and other uses
  - Raschel knit is a more open knit – often used to create lace or unique patterns

Comparison of Filling & Warp Knits Table

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