Journal of Textiles, Coloration and Polymer Science
https://jtcps.journals.ekb.eg/

Overview of Different Fabric Structures

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Abstract

Fabric is one of humanity's most basic needs, not only for clothing but also for aesthetic and utilitarian reasons. Fabric appearance, texture, suitability for end-use, and other factors are influenced by the fabric-forming process or fabrication procedure. The structure of these fabrics varies based on the interlacement/interloping pattern of yarns, which controls the fabric's qualities. A textile is a flexible material made of a web of synthetic or natural fibres (yarn or thread). Wool, flax, cotton, hemp, or other basic materials are spun into long strands to create yarn. To create a textile, one must weave, knit, crochet, knot, felt, or braid. A successful design must involve consideration of essential factors, including the pattern, theme and placement of motifs, style of presentation, and use of colour. These considerations alone support the creation of a separate professional category for textile design.

Keywords: Fabric Construction, weave, knit, crochet, knot, felt.

Introduction

The creation of inventive new ideas that involve a radical innovation or solution to a problem, as well as the radical reformulation of problems, is frequently seen as an example of creativity. The sudden insight that affects a designer as critical during problem solving is imagination, which involves the production of ideas that were not previously available as well as the generation of various ways of viewing events.[1]

Fabric is one of humanity's most basic needs, not only for clothing but also for aesthetic and utilitarian reasons. There are several different ways to make cloth, the most common of which are weaving and knitting. Fabric is created by interlacing and interloping in these processes. Fabric appearance, texture, suitability for end-use, and other factors are influenced by the fabric-forming process or fabrication procedure. The structure of these fabrics varies based on the interlacement/interloping pattern of the yarns, which controls the fabric's qualities. [2]

Fabric's structural architecture has a considerable impact on its aesthetics. To achieve the intended results, the fashion industry also focuses on the design of the base cloth. As we look around, we can see that fabric is used in a wide range of applications, from shirting to home and technical textiles. Fabric formation procedures (weaving and knitting) produce fabrics with vastly different structural characteristics. Knitted fabrics have a looped structure, whereas weaving threads are relatively straight with some crimp.

As a result, woven fabrics have lower extensibility than knitted fabrics. A little change in the interlacement/interloping pattern might result in a different fabric with completely different characteristics.[2, 3].

A designer begins by considering the concept and context of the problem, then after putting out a solution to address the issue, he converts the initial stage into the finished design. To produce textiles that satisfy client needs, textile designers, a particular category of designer, must combine knowledge of both historical and modern developments in printing technology, wet processes, dyestuffs, technology chemistry, fibre properties, fabric structures, mixed media, painting techniques, design styling, and design repeat layouts. This procedure is intricate. These considerations alone

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(Received 26/07/2022, accepted 07/08/2022)
DOI: 10.21608/jtcps.2022.152641.1131

support the creation of a separate professional category for textile design.[4]

Clothing is one of the three major necessities of existence, along with food and housing, is. It is crucial that clothes be affordable, which calls for increased manufacturing effectiveness, which can be attained by investing in a system for pattern design. A textile is a flexible material made of a web of synthetic or natural fibres (yarn or thread). Wool, flax, cotton, hemp, or other basic materials are spun into long strands to create yarn. To create a textile, one must weave, knit, crochet, knot, felt, or braid.[5]

An essential part of producing textiles is textile design. A successful design must involve consideration of essential factors, including the pattern, theme and placement of motifs, style of presentation, and use of colour. Themes or motifs for designs can be obtained from a variety of sources, including ancient texts, geometrical patterns, traditional symbols, and images of natural or man-made objects. A printing procedure is required for a design to be printed on fabric.[6]

1.1. Textile Fabric

The word "textile" comes from the Latin word “textiles” and the French word “texere”, which both mean "to weave," and it was originally only applied to woven materials. Now Weaving, knitting, crocheting, braiding, and other non-woven textiles are all considered textiles. New advancements have widened the definition of this term to include filament, fibre, and yarn that can be transformed into the fabric, as well as the resulting material. Threads, cords, ropes, braids, lace, needlework, nets, and materials made by weaving, knitting, bonding, felting, or tufting are all considered textiles. Fibres must have certain desirable features to be helpful in textiles, such as strength, abrasion resistance, flexibility, and moisture absorption. [7]

Traditional fabrics (woven, knitted, and braided) are made by spinning fibres into yarn and then weaving them into the fabric (see **Figure 1**). On the other hand, fabrics are also produced directly from the fibres, without being converted into yarn. Such fabrics are termed nonwoven fabrics (see **Figure 2**). [2]

The fabric production method used is mostly determined by the qualities needed in the fabric. The number of stages involved and the pace of manufacturing, on the other hand, impact the cost of fabrication.[8]

The fabric is less expensive the fewer steps and the shorter the procedure are. Fabric creation techniques have recently been automated, resulting in greater quality, faster response to market demand, and more flexibility in production.

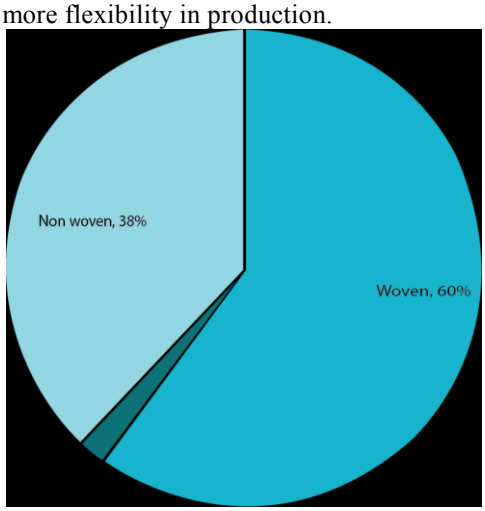


Figure 1: Uses Percent of different technical textile materials [2]

1.1.1. Type of textiles

1.1.1.1. Woven Textiles

A woven fabric is made by interlacing yarns at a 90-degree angle in a step-by-step method. There are two sets of yarns, one in the vertical axis (warp) and the other in the horizontal axis (weft). The warp runs the length of the fabric while the weft runs the width. Different interlacing yarn manipulations result in diverse structured patterns or designs, which can be generated using various procedures and approaches.[9]

1.1.1.2. Non-woven Textiles

The fabric is not necessarily woven; in certain cases, fibres are combined in chemical solutions and a layer of fabric is generated through fibre bonding, giving the fabric a padded appearance. Felt made from wool fibres is the most prevalent non-woven fabric. These are used to produce doormats, blankets, and other items.[10]

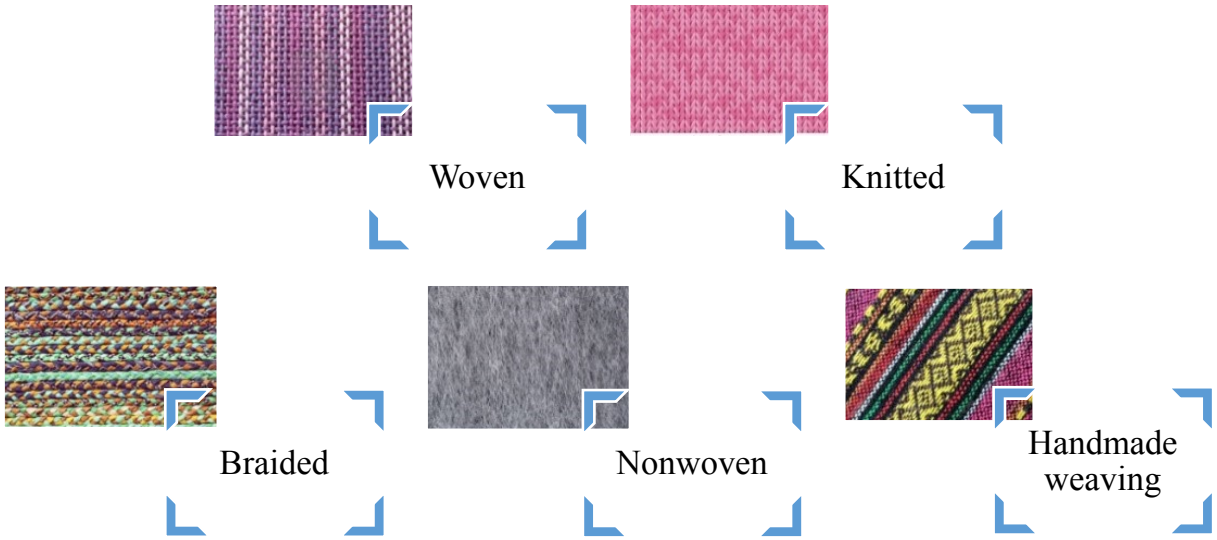


Figure 2: Different types of textile fabrics

1.1.1.3. Knits

Knitted fabric differs from woven fabric in that it uses a whole distinct yarn interlacement technique. It is made up of a series of loops that are joined one by one by a single thread. Knits are extremely stretchy and can stretch up to 500 percent.This method is used to make traditional woollen sweaters. Knits are now as popular as woven materials and are used in T-shirts, socks, and a variety of other clothing, particularly sportswear.[11]

1.1.1.4. Surface Embellished Textiles

Surface decoration techniques make any cloth more appealing. There are several ways accessible, and the country has a long history of conventional technical knowledge. For adding value to textile surfaces, the most common techniques include embroidery, appliqué, patchwork, and fabric manipulation.[12]

1.1.1.5. Printed Textiles

The term "printed textile" refers to designs generated by applying colour to the surface of textiles using various printing technologies. Printed fabrics have a wide range of design options, ranging from simple to complicated.[13]

1.1.1.6. Resist Dyed Textiles

There are several procedures for resisting or blocking a specific region of a fabric before dying it to create various intriguing patterns. One of the oldest methods of producing designs on cloth is resist dyeing.[14]

1.1.1.7. Technical Textiles

Technical textiles are fabrics that are utilised for industrial applications.These textiles are made or processed with specialised procedures that have specific properties that meet a variety of technical and industrial requirements.[15]

1.1.2. Fabric construction

Fabric is any material that is woven, knitted, crocheted, braided, or bonded and can be used to make any end-use product, such as clothes. Fabric is a two-dimensional or three-dimensional construction made of any textile fibre that is drape-able, spreadable, and pliable. It can be worn, utilised as a utilitarian product for the interior or exterior, as home furnishings, or as an appealing piece of art.[16] Types of fabric construction are listed in **Figure 9**. Fabric is a woven or nonwoven material made up of natural or synthetic fibres called thread or yarn. Yarn is made by spinning raw fibres such as cotton, silk, wool, flax, or other materials into long strands. Felted materials are made by combining fibres by weaving, knitting, crocheting, knotting, or pressing them together. Fabric and cloth are used as synonyms for textile in textile trades such as tailoring and dressmaking. [17]

Fabric structure parameters are becoming increasingly significant in the textile manufacturing process, especially with the introduction of high-precision weaving and knitting. [18]

Fabric appearance, texture, and suitability for end-use are all influenced by the fabric-forming process or fabrication procedure. The interlacement/ interlocking pattern of the yarns determines the structure of these fabrics. The fabric's design refers to the interlacement/interlocking process. Fabric qualities are mostly determined by its design and the fibre content utilised as a raw material.

1.1.2.1. Woven fabrics

Fabric is only called a woven fabric if it consists of usually two interlacing yarns (warp and weft yarns). **[19]** The woven fabrics are made by interlacing two orthogonal sets of yarns, namely longitudinally organised warp yarns and crosswise arranged weft yarns. Over the weft thread, the warp yarn is alternately raised and lowered in a specified pattern. The weave design of the fabric refers to the precise pattern for interlacement distribution. The weaving pattern is represented as an orthogonal array of binary numbers in CAD. If the warp yarn is over the weft yarn at the crossover location, for example, it is signified by "1" and "0" in the opposite situation. An endless number of weaves can be created this way.[20]

The frequency of interlacement between warp and weft yarns determines the stiffness of a woven fabric. The fabric hardness improves as the number of intersections per repeat increases, while other parameters remain constant. If we compare a plain and a twill woven fabric with the same thread count and linear density, the latter will be less firmly compressed than the former due to less bend.[2]

There are complex/intricate structures generated by combining these basic weaves, such as (a) multilayer fabrics, (b) pile weave structures, and (c) jacquard designs (see **Figure 3**), in addition to these basic designs. These structures are widely employed in a variety of fields. The stitching pattern of the separate layers determines the structure of multilayer fabrics. It's either layer-by-layer or thickness-by-thickness. Terry towels and woven carpets are examples of pile weave structures. These constructions have an additional set of yarns termed pile yarns that occur on one or both sides of the fabric, in addition to the ground yarns.[21]

1.1.2.2. Knitted fabrics

Knitted fabrics are made up of a series of loops created from one or more yarns that are interlocked, with each row of loops catching into the previous row. As a result, unlike woven cloth, the threads do not follow a straight path but rather a meandering pattern. When exposed to external stress, these loops quickly stretch in multiple directions, providing more flexibility than woven materials. Knitted cloth can stretch up to 500 percent of its original length depending on knitting structure and yarn qualities. [22]

Knitted structures may more easily conform to complex shapes without creases, and knitting is a more flexible procedure for producing preshaped structures. [23, 24]

Knitted materials are more form-fitting than woven fabrics because of this, and are thought to be better suited to clothing that must be elastic or stretchable in reaction to the wearer's actions, such as socks and hosiery. Knitted clothing's elasticity allows them to better mould the body's outline. Knitting yarns typically have a low twist level, giving them more bulk and less drape than woven fabrics. Knitted fabrics are divided into two types: warp-knitted(a) and weft-knitted(b) (see **Figure 4**). [25]

In warp knitting, the yarns that make up the knitted fabric travel vertically (like warp threads in woven fabric). The thread in weft knitting horizontally moves across the fabric. The weft-knitted fabrics can be made by hand or by machine, whereas the warp-knitted fabrics can only be made by machines. The structural characteristics of fabrics made using these two processes differ significantly.[26]

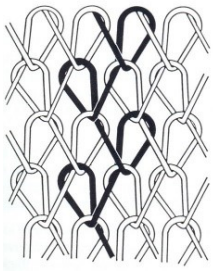
(a)

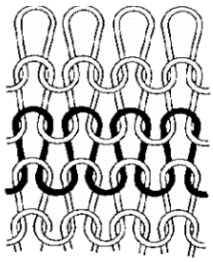
(b)

(c)

Figure 3: Complex/intricate structures generated by combining basic weaves

(a) multilayer fabrics, (b) pile weave structures, and (c) jacquard designs





(a) **(b)**

Figure 4: Types of knitted fabrics
warp-knitted (a) and weft-knitted(b)

Knit, tuck, and miss are the three basic stitches in a knitted fabric. Knitted fabric's look and physical qualities are affected by different stitches and stitch combinations. Different patterns are also generated in knitted fabrics using various stitches and yarns of various colors.[27]

1.1.2.3. Braided fabrics

Interlacing one, two, or more sets of yarns with one other or with other sets of yarns at an angle create braided constructions. The angle formed by the yarns and the product axis is usually half of this angle (termed the braiding angle). The braided samples have a small number of designs, with fewer than five is typically utilized. Braids can be manufactured in a tubular or flat construction (see **Figure 5**). [28, 29]

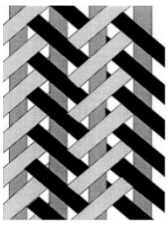


Figure 5: Braided constructions

1.1.2.4. Nonwovens fabrics

Textile fabric structures made from fibrous webs are known as nonwovens. The web can be bound together in a variety of ways, including mechanical tangling of fibres, adhesive application, thermal fusion, and chemical structure development. The fibre is the essential unit in the structure of a nonwoven fabric, and the distance between the fibres is the most important component. The spacing between consecutive fibres is typically several times the diameter of the individual fibres that make up the web. Nonwoven constructions are more flexible as a result of this. The properties of nonwoven textiles can be easily controlled and are dependent on the fibre properties, the fibre arrangement in the web and the qualities of any binders or binding procedures utilised. [30]

The strands that run the length of the fabric or parallel to the selvedge are known as the warp. Ends is another name for them. Aside from the warps, another pair of strands move perpendicular to the warps in a woven fabric. Wefts are what they're called. To produce a fabric, they are intertwined with warps in a transverse orientation. Picks or fillings are other names for them (see **Figure 6**).

1.1.3. Woven fabrics

Woven fabrics are produced by the interlacement of two sets of yarns perpendicular to each other, that is, warp and weft forming a stable structure, while knitted fabrics are made up of interconnected loops of yarn. The bent yarn in a loop provides stretch, comfort, and shape retention properties to the knitted fabric. However, knitted fabrics are generally less durable than woven fabric. Such properties help to determine the end-use of a specific fabric. The chemical and/or mechanical bonding or interlocking of fibres produces a fabric structure known as the nonwoven fabric (see

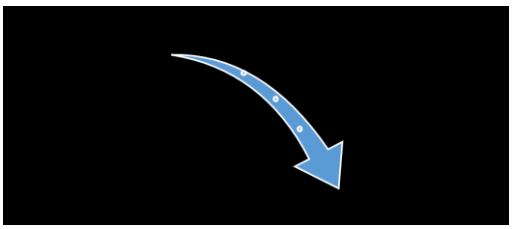


Figure 7). The process of fabrics formation also determines the name of fabric produced, for example, felt, lace, double-knit, and tricot. [2, 31]

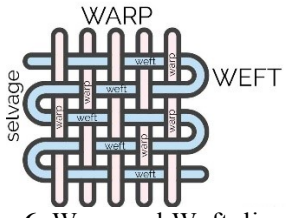


Figure 6: Warp and Weft directions

1.2. Weaving process

Weaving is a mixture of science and art. [7] Weaving is the process of forming a fabric by interlacing the warp and filler yarns. The pattern of interlacing has a significant impact on the fabric's structure and appearance. As a result, fabrics constructed of the same yarns can have vastly varied appearances and qualities depending on the

interlacing pattern. There is virtually no limit to the number of weaves that can be created. This gives the designer limitless options for creating cloth for any use. The designer's imagination is the sole limit to the possibilities. Textile technology has a clear edge in this regard. [7]

Weft threads interweave ups and downs according to particular organizational norms in traditional woven fabrics, which are made up of a set of mutually perpendicular warps and a set of weft yarns. Plain weave, twill weave, and satin weave are the most common 2-D woven fabric structures used in scaffolds today and the performance of the woven fabric can be adjusted by controlling the warp and weft density (the number of warp and weft yarns per unit length), yarn fineness, and the interlacing law. [32]

Plain weave fabrics have a 1:1 ratio of warp and weft threads, and the fabric has reduced flexibility but strong wear resistance. Because the interwoven points of the twill weave create a slanted line on the fabric surface, the twill fabric is more supple than plain cloth. Because the satin fabric has longer floated and fewer interlacing points than plain fabric, there are more exposed sections of the yarns in satin fabric, making it softer and less wear-resistant. Weft density, warp density, fabric weave, and side end number are all weaving criteria. These variables have an impact on the fabric's structure and qualities. Different mechanical stimuli and topographies are provided by the textile-based scaffolds, which regulate cell behavior. [33]

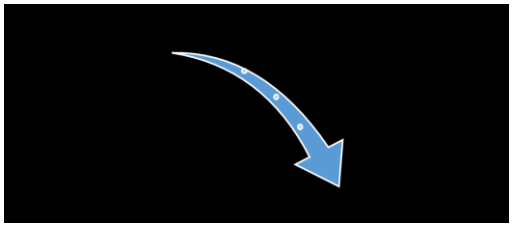


Figure 7: producing steps of woven fabric

The process of weaving is defined as the interlacing of warp and weft strands at right angles to each other. The possibilities for interlacing warp and weft yarns are nearly unlimited. The warp yarn is sometimes referred to as the ends, while the weft yarn is referred to as the pick or filler. To function as a single entity, interlaced yarns must have sufficient cohesive forces between them, and woven fabrics must have an unusually high length or width to thickness ratio. The process of weaving threads into fabric is done on a "loom," which is also known as a "weaving machine." The warp and weft yarns must be prepared before weaving. Weft yarns that are spun directly are used as is, although they are occasionally rewound in small bobbins on a winding machine to make a bigger weft yarn package. Before being woven, the warp yarn undergoes warping and sizing. The woven fabrics are sent to the folding section for inspection and grading after weaving. [34]

1.2.1. Classification of weaved structure

There are two major groups of weaved structures

1.2.1.1. Simple Structure

The structure is called Simple Structure when the Ends and Picks intersect at a straight angle and are parallel to each other. There is only one series of ends and one series of picks in these structures, and they both contribute equally to performance, utility, and aesthetic appearance.[35]

1.2.1.2. Compound Structure

There are multiple series of ends and picks in this structure, some of which will be responsible for the performance and some of which will be used solely for adornment. They might not even be parallel to one another. **[17]**

1.2.2. The basic weave patterns of textiles

Fabrics can be made using a variety of weave styles and variations of each style. The weaves in this image as shown in Error! Reference source not found. are those that were initially used to make cloth, but their variations allow them to be utilised for making clothes and other garments.

The black point means that the warp yarn is over the weft yarn, and the white point means that the weft yarn is over the warp yarn

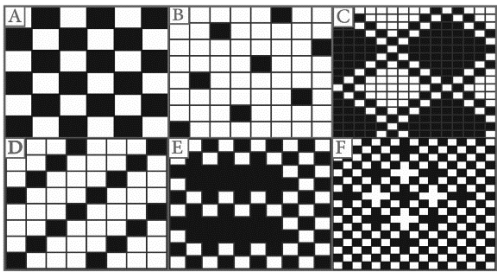


Figure 8: Weave kinds (A) Plain weave, (B) Satin weave, (C) Honeycomb weave, (D) Twill weave, (E) Fancy cord weave and (F) Fancy mesh

1.2.2.1. Basic Weaves

The weave is the process of interlacing pattern warp and weft strands to make a woven cloth. These patterns are created based on the finished fabric's required qualities. These designs come in a wide variety of complexity, from basic interlacements to complicated interlacements, all of which impart unique purposes to the finished fabric. The basic weaves consist of three types of weaves: plain, twill, and satin/sateen weaves. Small repeat

sizes, ease of formation, and identification are all characteristics of these fundamental weaves. [7]

1.2.2.2. Plain weave

Plain is the most basic weave, in which the warp and weft threads alternately interlace resulting in the most interlacements. The structure gains stiffness and stability as a result of this maximum interlacement. Plain weave is known by trade names such as broadcloth, taffeta, shantung, poplin, calico, tabby, and alpaca. To weave its fundamental unit, at least two ends and two picks are required. This weave requires a minimum of two heald frames, but more than two (multiples of basic weave) heald frames can be used to weave this design. [7] **Figure 10** shows plain weave fabrics construction.

1.2.2.2.1. Warp Rib

Plain weave with warp ribs is a modified version of the plain weave. It differs from simple plain weaves in that it features 1/1 interlacements in the filling direction. The creation of cords, ridges, or texture across the warp direction of the fabric is the outcome of this modified interlacement. The clustering of the filler yarns creates these cords or ridges. The warp rib repetition is always on two warp yarns. The first warp yarn is wound in the same way as the first, while the second warp yarn is wound in the opposite direction.[2]

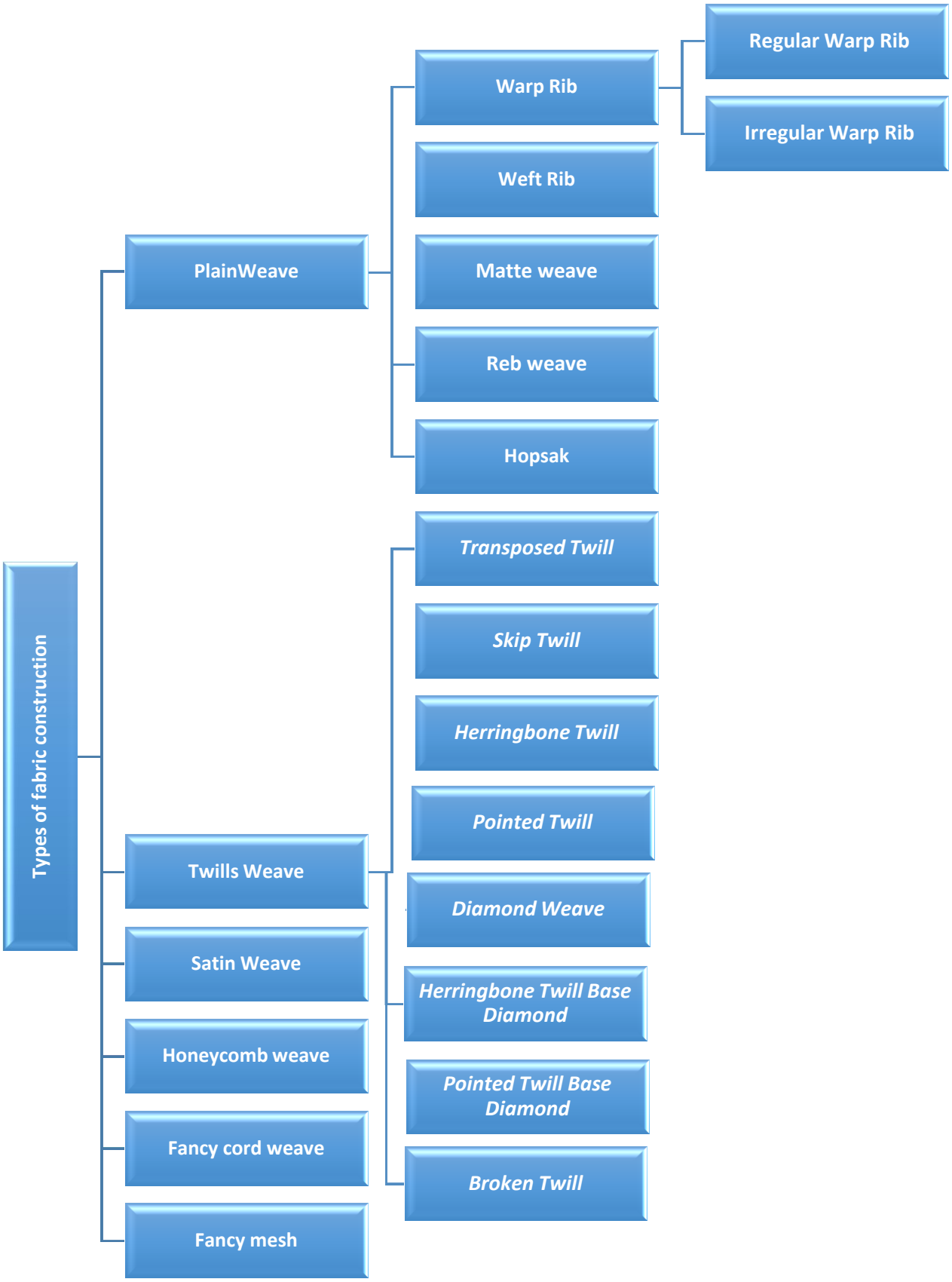


Figure 9: Types of fabric construction

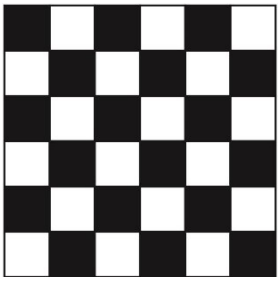


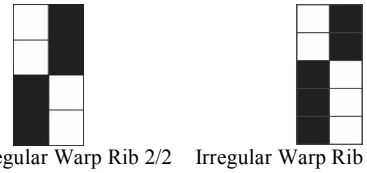
Figure 10: plain weave (1/1) fabrics construction

a) Regular Warp Rib

When the numerator and denominator of the weave formula have the same value as in the case of 2/2, the warp rib is extended.3/3 and 4/4 are two further examples of normal warp ribs.[2] **Figure 11** shows regular Warp Rib weave fabrics construction.

b) Irregular Warp Rib

The final pattern will be an irregular warp rib if the numerator and denominator of the weave formula for the warp rib have different values. 2/3 warp rib, for example, is irregular. [2] **Figure 11** shows irregular Warp Rib weave fabrics construction.



Regular Warp Rib 2/2 Irregular Warp Rib 3/2

Figure 11: Regular and irregular Warp Rib fabrics construction

1.2.2.2.2. Weft rib

Plain weaves can also be modified with weft ribs. It differs from simple plain weaves in that it has 1/1 interlacements in the warp direction. The creation of cords, ridges, or texture across the fabric's weft direction is the outcome of this modified interlacement.[2]

a) Regular Weft Rib

When the numerator and denominator of the weave formula have the same value as in the above example of 2/2, the weft rib is extended.3/3 and 4/4 are two further examples of normal weft ribs.[2] **Figure 12** and **Figure 11** shows regular weft rib weave fabrics construction.

b) Irregular Weft Rib

The final pattern will be irregular weft rib if the numerator and denominator of the weave formula for weft rib have different values. A 2/1 weft rib, for example, is an irregular weft rib. The design is still called an irregular weft rib if only a section of the formula has the same numerator and denominator value. An uneven weft rib, for example, is 1/3-2/1-3/1.[2] **Figure 12Figure 11** shows irregular weft rib weave fabrics construction.

Regular Weft Rib2/2 irregular Weft Rib 2/1

Figure 12: Regular and irregular weft Rib fabrics construction

1.2.2.2.3. Matt Weave

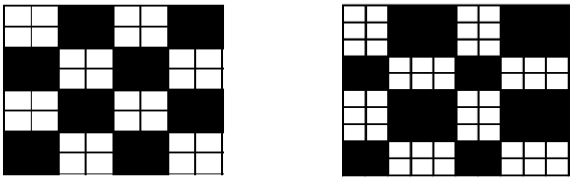
This weave is made by stretching the plain weave in both the warp and weft directions at the same time, resulting in two or more threads that work in the same direction in both directions. In this weave, the squares are the same size on both sides of the cloth, with the same number of warp and weft yarns on both sides. Matt weave is also known as basket weave, hopsack weave, or full Panama weave. A minimum of two healed frames are required for this weave. The matt weaves can be extended further to give more prominence, but due to the flexible construction, this is limited, and they can be adjusted in a variety of ways. [8, 36]. There are two kinds of Matt Weave as shown in Figure 13

a) Regular Matt Weave

A regular matt weave is defined as a matt weave with equal spacing on both sides of the fabric. This sort of interlacement is used only in fine fabrics and corresponds to loose structures.

b) Irregular Matt Weave

Irregular matt weave is defined as a matt weave with unequal spacing on both sides of the fabric.



Regular matt weave (2/2) Irregular matt weave (2/3)

Figure 14: Regular and irregular Matt weave fabrics construction

1.2.2.2.4. Reb weave

To create the rib effect, numerous threads are frequently combined into one, or a thick yarn is used in either the warp or weft direction. A simple weave pattern is used for the interlacing**.** [8]

1.2.2.2.5. Hopsak

Hopsak is a polyamide plain-weave fabric that is expressive and flat. In high-contrast, brilliantly hued, or delicate combinations of warp and weft threads, the duotone colors give a range of design choices. Hopsak is a highly durable and sturdy material that may be utilized in both private and public spaces.

1.2.2.3. Twills Weave

Twill weave is a basic weave that is noted for its interlacing pattern, which results in a diagonal line creation in the cloth. This weave, as well as its variations, is used for decorative purposes. When opposed to plain weave, twill has a closer placement of yarns due to less interlacement, giving it more weight and drape. In simple twill as shown in **Figure 15**, the interlacing pattern's outward and upward movement always imparts a diagonal line to the design. Twill is classified as right-hand or left-hand twill based on how the twill line propagates.[31]

Plain weave has more interlacements than twill weave, hence the threads in plain weave have a larger contact area due to the interlacements. When compared to twill weave, the plain weave has better tensile resistance. Twill weaves have longer floats than plain weaves, hence thread slippage is greater in this weave when it is torn.

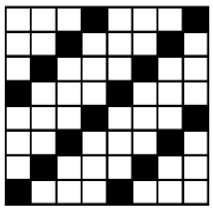


Figure 16: Twills weave fabrics construction

1.2.2.3.1. Transposed Twill

Rearranged twill is another name for transposed twill. Only the original twill weave is rearranged in this twill to create more appealing motifs. The transposition simply interrupts the basic twill line at the break unit's specified intervals. The technique of transposition is very similar to that of twill breaking as shown in **Figure 17**

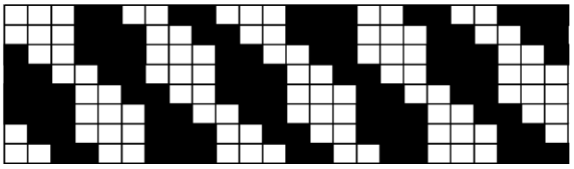


Figure 18: Transposed twill (4/4) weave fabrics construction

1.2.2.3.2. Herringbone Twill

To generate a different impression as shown in **Figure 19** , this twill also relies on the reversal of the direction. The way they're made differs from the way waved twills are made.

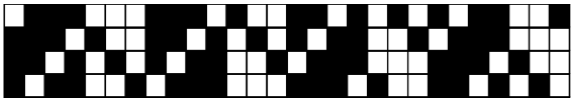


Figure 20: Herringbone twill (3/1, 4R, 3L) weave fabrics construction

a) **Horizontal Herringbone Twill**

Horizontal herringbone twill is herringbone twill that has been extended in the warp direction. Shirts and overcoats are the most typical uses for this weave.

b) **Vertical Herringbone Twill**

Basic twill extended in the weft direction is known as vertical herringbone. This twill is employed in fabrics for hanging and soft furnishing.

1.2.2.3.3. Skip Twill

The twill lines are formed in the same direction by this derivative of twill. Drawing skip twill is quite similar to drawing herringbone twill as shown in **Figure 21** . The twill line progression in the same direction at the reversal is the only distinction between the skip and the herringbone.

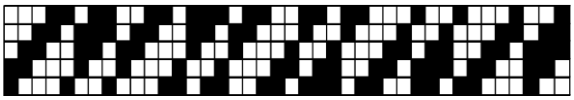


Figure 22: Skip twill (2/3, 5R, 3R) weave fabrics construction

1.2.2.3.4. Diamond Weave

The diamond weave is another type of twill derivative that may be made in two ways: pointed twill base diamond weave and herringbone twill base diamond weave. This weave is divided into four sections. A diamond weave's repetition unit is made up of all of the quadrants. This weave's name comes from the development of a unique diamond-like shape.

1.2.2.3.5. Pointed Twill Base Diamond

It's made with pointed twill. The vertical and horizontal axes of this weave are symmetrical. The design's repeat is calculated by multiplying the basic weave's digits by two and then adding them

together. The number of ends and picks in the final design will be the solution.

1.2.2.3.6. Herringbone Twill Base Diamond

This is a diamond weave that employs the herringbone pattern. The diagonal axis of this weave is symmetrical. Quadrants that are diagonally opposite each other are similar. The design's repeat calculation is the same as in the pointed base diamond weave.

1.2.2.3.7. Broken Twill

The standard twill is broken at certain intervals to create this twill as shown in **Figure 23**. This weave can be used to create a variety of unique designs. The most basic and popular approach to break a regular twill is to stop it and reverse the next ends according to the broken unit. [31]

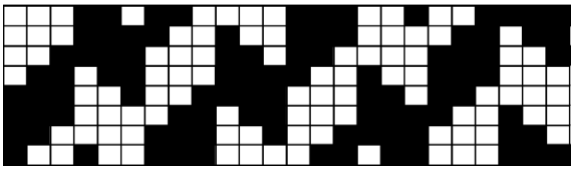


Figure 24: Broken twill (4/4) weave fabrics construction

1.2.2.3.8. Elongated Twill

The rate of advancement in regular twill is normally one step ahead and one step forward. In elongated twills as shown in **Figure 25**, the rate of advancement of the twill is changed. The change may be in both directions as per requirement. The advancement will be two at least or more according to the requirement.[2]

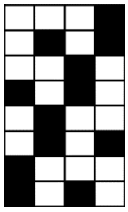


Figure 26: Elongated twill (2/2+1/3) weave fabrics construction

1.2.2.3.9. Pointed Twill

This is the most often used twill weave kind. It's made by reversing the twill line at predetermined intervals to mix left- and right-hand twills into a single design as shown in **Figure 27** . It's also known as waved twill or zigzag twill. The twill can be reversed either horizontally or vertically.

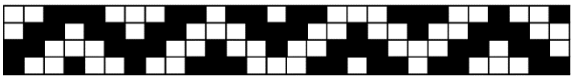


Figure 28: Pointed twill (2/2, 4R, 3L) weave fabrics construction

a) Horizontal Pointed Twill

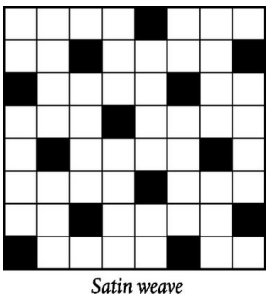
When the diagonal twill line is reversed on the warp ends, this sort of twill is made. The number of ends is greater than the number of picks in this situation. The pointed draught is utilized in this form of twill.

b) Vertical Pointed Twill

When the twill line on the picks is reversed, the vertically pointed twill is made. In this situation, the number of picks will be more than the number of warp ends in unit space. Due to a large number of picks, this type of design often necessitates dobby shedding, which is difficult to achieve on simple tappet looms.

1.2.2.4. Satin Weave

Satin/sateen is a basic weave that, unlike twill, does not have a regular pattern as shown in **Figure 29** . The fabric's surface is either warp or weft-faced. Satin is warp facing, which means that the warp threads are visible on the entire surface of the fabric save for one thread interlaced with other yarn series. It's called sateen if it's weft facing, which means the weft threads are largely visible on the fabric's surface. The single interlacement of warp and weft threads in a single repeating unit distinguishes this weave. Among the fundamental weaves, these have the fewest interlacement points. As a result, it enhances the shine and smoothness of the fabric's surface.[37]



Satin weave

Figure 30: Satin weave fabrics construction

1.2.2.5. Honey Comb Weave

Because of its honey bee web-like structure as shown in **Figure 31** , this weave is given its name**.** It creates ridges and hollow structures that provide the impression of a cell. Both warp and weft threads move freely on both sides of this weave, which is combined with a rough structure. This weave produces a cloth with more float all over it**.**

This weave is further subdivided into three different varieties, Single-Ridge Honey Comb, Double-Ridge Honey Comb, and Brighton Honey Comb. [30]

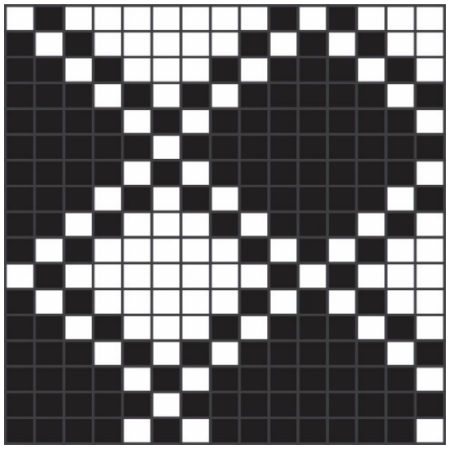


Figure 32: Honey Comb weave fabrics construction

1.2.2.6. Huck a Back Weave

The huck a back weaves are toweling fabrics. They're called honeycomb effects since they're commonly connected with honeycomb fabrics. They're made by alternating between a floating and a plain weave as shown in **Figure 33** . A variety of weaves are derived from these weaves, which is interesting. Huck a back weaves can be used to create thick, hefty textures. [31]

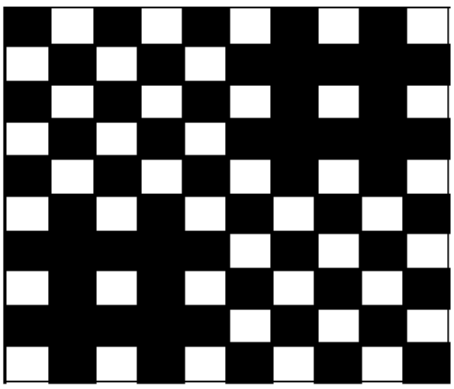


Figure 34: Huck a Back weave fabrics construction

1.2.2.7. Crepe Weave

Crepe weave is a term used to describe weaves that do not have a defined pattern. These weaves may have a twill-like appearance, but they lack the prominence of twills. [2] Crepe weaves, often known as "crape" or "oatmeal" fabrics, are a useful variation of simple weaves with a pebbly or crinkled (rough) surface. The type of crepe fabric is determined by the size of the pebbles and their placement on the cloth surface. The crepe effect can be obtained by using crepe yarns (highly twisted) or a crepe weave, as well as by using a particular finishing procedure, such as embossing. There are various ways to draw crepe weaves, however the most popular ones as shown in **Figure 35** below. Crepe weaves are frequently combined with other primary weaves in complicated jacquard designs for brocade and kindred fabrics to generate several different effects. Crepe weaves are commonly used to create the ground of figured fabrics. Kimonos, smocks, women's and children's outfits, curtains, and needlework are all examples of crepes in use. [31]

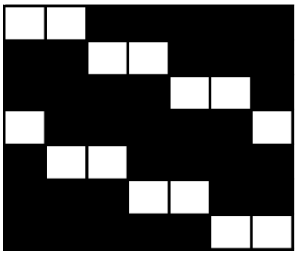


Figure 36: Crepe (sateen based, 7 end) weave fabrics construction

1.2.2.8. Mock Leno Weave

This fabric has a weave that similar to gauze. Four quadrants make up the weave as shown in **Figure 37**. The symmetric weave appears in the first and third quadrants, whereas the opposing weave appears in the second and fourth quadrants.[38]

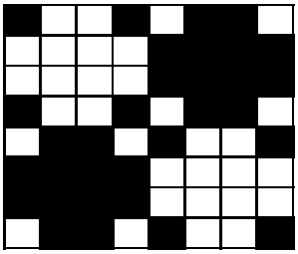


Figure 38: Mock Leno weave fabrics construction

1.2.2.9. Welts and Pique

A simple face fabric with a sequence of warp and weft threads, as well as several stitching threads, makes up a pique weave. Because of the horizontal lines, this weave is one of a kind (weft-wise).[31] A picture of such a pique weave is shown in **Figure 39**

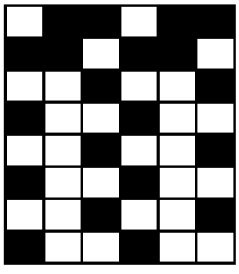


Figure 40: Welts and Pique weave fabrics construction

Refereces

1. Gürcüm, B., "Conceptual Design Method and Creativity in Textile Design". *J Textile Eng Fashion Technol*, **3**(1) 00086 (2017)
2. Nawab, Y., Hamdani, S.T.A. and Shaker, K., "Structural Textile Design: Interlacing and Interlooping". CRC Press (2017)
3. Ahmad, H.S., "Introduction to Knitting", in *Structural Textile Design* CRC Press. p. 185-196 (2017)
4. Farzadfar, F., Delavari, A., Malekzadeh, R., Mesdaghinia, A., Jamshidi, H.R., Sayyari, A. and Larijani, B., "Nasbod 2013: Design, Definitions, and Metrics". *Archives of Iranian medicine*, **17**(1) 0-0 (2014)
5. ElegbedeAdedayo, W., OlusanyaOlamide, O., OyediranMayowa, O. and Amole Abraham, O., "Development of a Matlab Based Pattern Design System for Plain Textile (Ankara)".
6. Ashitey, S., "Innovative Methods of Developing Patterns for Textile Screen Printing". *Kumasi: Kwame Nkrumah University of Science and Technology*, (2013)
7. Adanur, S., "Hand Book of Weaving". Sulzer Textil Limited Switzerland CRC Press is an imprint of Taylor & Francis Group (2001)
8. Horrocks, A.R. and Anand, S.C., "Handbook of Technical Textiles", ed. A.R. Horrocks and S.C. Anand. Volume 1: Technical Textile Processes (2016)
9. Lombaert, F., "Woven Fabrics and Their Applications in Technical Segments Picanol Today". *Dubai Techtextil Symposium*, (2014)
10. Chaudhari, D.S. and Mandot, A., "Nonwoven Fabrics in Apparel". *Fibre2fashion online journal*, (2008)
11. Raichurkar, P., "To Study the Impact on Process Parameter of Knitted Fabric". *Fibre2fashion.com*, (2011)
12. K, M., "Embellishment Materials Used for Developed Articles from Discarded Textiles". *Journal of Textile Science & Engineering*, **05**(2015)
13. Vineet JoshiChairman, C., "Printed Textile Students Handbook + Wđăđəđăů Dăŷzăů". The Secretary, Central Board of Secondary Education, Shiksha Kendra, 2, Community Centre, Preet Vihar, Delhi - 110301: National Institute of Fashion Technology (2014)
14. WAHLMAN, M. and CHUTA, E., "Sierra Leone Resist-Dyed Textiles", in *The Fabrics of Culture: The Anthropology of Clothing and Adornment*, M.C. Justine, A.S. Ronald, C.I.I.C.o. Anthropological, and S. Ethnological, Editors De Gruyter Mouton. p. 447-466 (2011)
15. Shishoo, R., "Technical Textiles - an Overview of the State of the Art". (2019)
16. Sachdeva, K., Suri, M. and Bhagat, S., "Effect of Fabric Construction on the Longevity of Aged Cotton Fabric". *International Journal of Engineering Research and Applications*, **10** 49-61 (2020)
17. Javed, M. and Yadav, S., "Woven Textiles". Preet Vihar, Delhi: NATIONAL INSTITUTE OF FASHION TECHNOLOGY (2013)
18. Zheng, D., Han, Y. and Hu, J.L., "A New Method for Classification of Woven Structure for Yarn-Dyed Fabric". *Textile Research Journal*, **84**(1) 78-95 (2014)
19. Cherif, C., "Textile Materials for Lightweight Constructions". *Technol Methods Mater Proper*, (2016)
20. Lombaert, F., "Woven Fabrics and Their Applications in Technical Segments Picanol Today". *Dubai Techtextil Symposium*, (2014)
21. Mathur, K. and Seyam, A.-F., "Color and Weave Relationship in Woven Fabrics". Advances in Modern Woven Fabrics Technology. Rijeka, Croatia: InTech (2011)
22. Purchas, D.B. and Sutherland, K., "Woven Fabric Media", in *Handbook of Filter Media* Elsevier Science. p. Pages 35-80 (2002)
23. Milwich, M., "Types and Production of Textiles Used for Building and Construction", in *Types and Production of Textiles Used for Building and Construction*, G. Pohl, Editor Woodhead Publishing. p. Pages 13-48 (2010)
24. Gong, R.H., "Yarn to Fabric: Specialist Fabric Structures", in *Textiles and Fashion*, R. Sinclair, Editor Woodhead Publishing. p. 337-354 (2015)
25. Gupta, B.S. and Edwards, J.V., "Textile Materials and Structures for Topical Management of Wounds", in *Advanced Textiles for Wound Care (Second Edition)*, S. Rajendran, Editor. p. Pages 55-104 (2019)
26. Schrank, V., Beer, M., Beckers, M. and Gries, T., "Polymer-Optical Fibre (Pof) Integration into Textile Fabric Structures", in *Polymer Optical Fibres*, C.-A. Bunge, T. Gries, and M. Beckers, Editors Woodhead Publishing. p. 337-348 (2017)
27. Wong, W.-y., Lam, J., Kan, C.-W. and Postle, R., "Influence of Knitted Fabric Construction on the Ultraviolet Protection Factor of Greige and Bleached Cotton Fabrics". *Textile Research Journal*, **83** 683-699 (2013)

28. Jiao, Y., Li, C., Liu, L., Wang, F., Liu, X., Mao, J. and Wang, L., "Construction and Application of Textile-Based Tissue Engineering Scaffolds: A Review". *Biomaterials Science*, **8**(13) 3574-3600 (2020)
29. Wucher, B., "Predicting and Compensating Distortions of Composite Parts", (2016)
30. Sinclair, R., "Textiles and Fashion". Woodhead Publishing Limited in association with The Textile Institute (2015)
31. Gokarneshan, N., "Fabric Structure and Design". New Age International (2004)
32. Liberski, A., Ayad, N., Wojciechowska, D., Kot, R., Vo, D.M.P., Aibibu, D., Hoffmann, G., Cherif, C., Grobelny-Mayer, K., Snycerski, M. and Goldmann, H., "Weaving for Heart Valve Tissue Engineering". *Biotechnology Advances*, **35**(6) 633-656 (2017)
33. Gilmore, J., Yin, F. and Burg, K.J.L., "Evaluation of Permeability and Fluid Wicking in Woven Fiber Bone Scaffolds". *Journal of biomedical materials research. Part B, Applied biomaterials*, **107**(2) 306-313 (2019)
34. Kova evj, S. and Schwarz, I. "Weaving Complex Patterns from Weaving Looms to Weaving Machines". (2015)
35. Ahmady, G., Mehrpour, M. and Nikooravesh, A., "Organizational Structure". *Procedia - Social and Behavioral Sciences*, **230**(2016)
36. Yuhazri, M.Y., Amirhafizan, M.H., Abdullah, A., Sihombing, H., Saarah, A.B. and Fadzol, O.M., "The Effect of Various Weave Designs on Mechanical Behavior of Lamina Intraply Composite Made from Kenaf Fiber Yarn". *Materials Science and Engineering*, **Volume 160**(Issue 1)(2016)
37. Alderman, S., "Mastering Weave Structures", ed. L. Ligon. 201East Fourth street: Interweave Press,Inc (2004)
38. SHENTON, J., "Woven Textile Design". Laurence King Publishing Ltd, 224 pages (2014)

نظرة عامة على التراكيب النسجية المختلفة

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الملخص

النسيج هو أحد أهم احتياجات البشرية ، ليس فقط للملابس ولكن أيضًا لأسباب جمالية ونفعية. يتأثر مظهر النسيج وملمسه ومدى ملاءمته للاستخدام النهائي وعوامل أخرى بعملية تشكيل النسيج أو إجراءات التصنيع. يختلف هيكل هذه الأقمشة بناءً على نمط التشابك / التشابك للخيوط ، والتي تتحكم في صفات النسيج. النسيج مادة مرنة مصنوعة من شبكة من الألياف الاصطناعية أو الطبيعية (خيوط أو خيوط). يتم غزل الصوف أو الكتان أو القطن أو القنب أو أي مواد أساسية أخرى في خيوط طويلة لصنع الخيوط. لإنشاء نسيج ، يجب على المرء أن يحيك ، أو يحبك ، أو كروشيه ، أو عقدة ، أو لباد ، أو جديلة. يجب أن يتضمن التصميم الناجح مراعاة العوامل الأساسية ، بما في ذلك النمط والموضوع ومكان الزخارف وأسلوب العرض واستخدام اللون. هذه الاعتبارات وحدها تدعم إنشاء فئة مهنية منفصلة لتصميم المنسوجات.

الكلمات الرئيسية: التراكيب النسجية، نسج ، تريكو ، كروشيه ، عقدة ، لباد