

KARL MAYER

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Introduction into Warp Knitting
In-house Exhibition Greensboro 2016

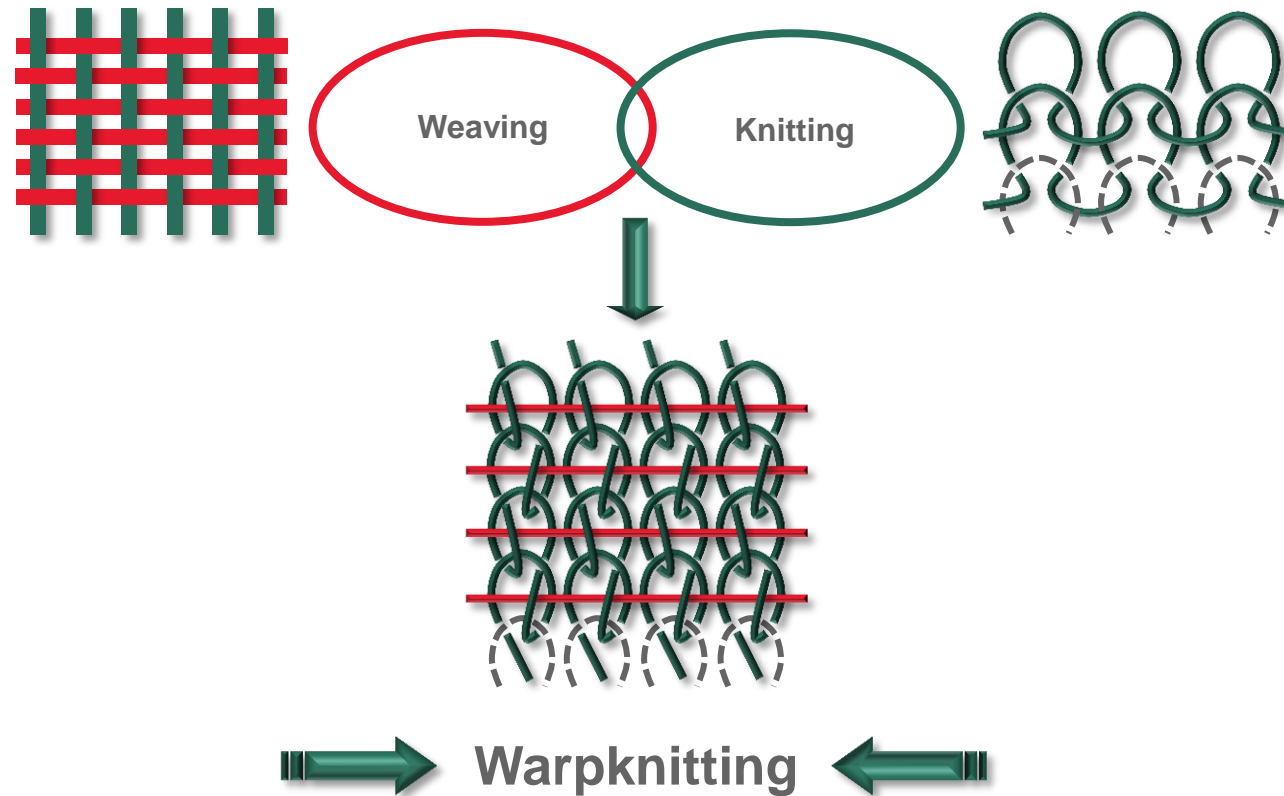
In-house Exhibition USA

Introduction into Warp Knitting

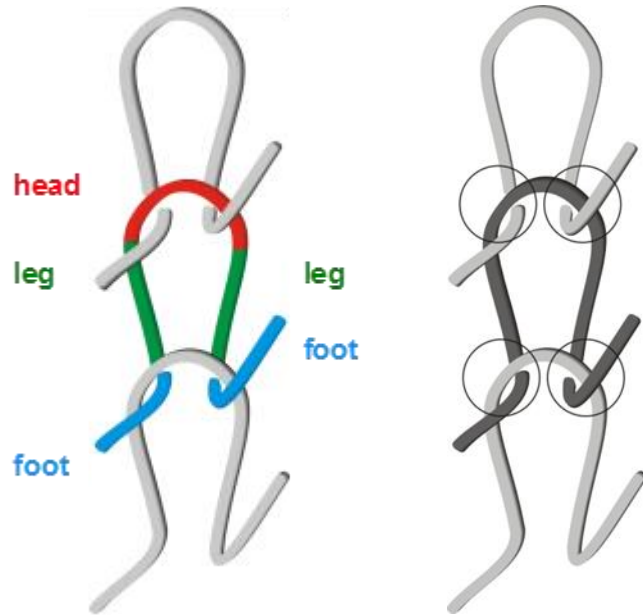
Instructor: Robert Kuna



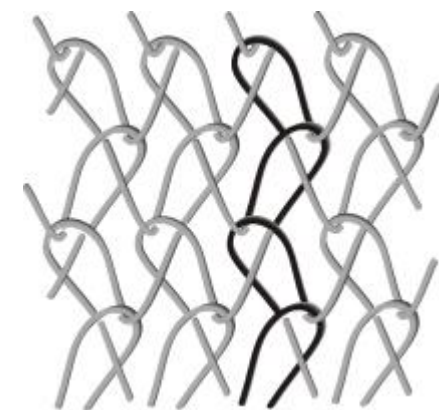
Weaving + Knitting = Warp knitting



Warp knitting principle

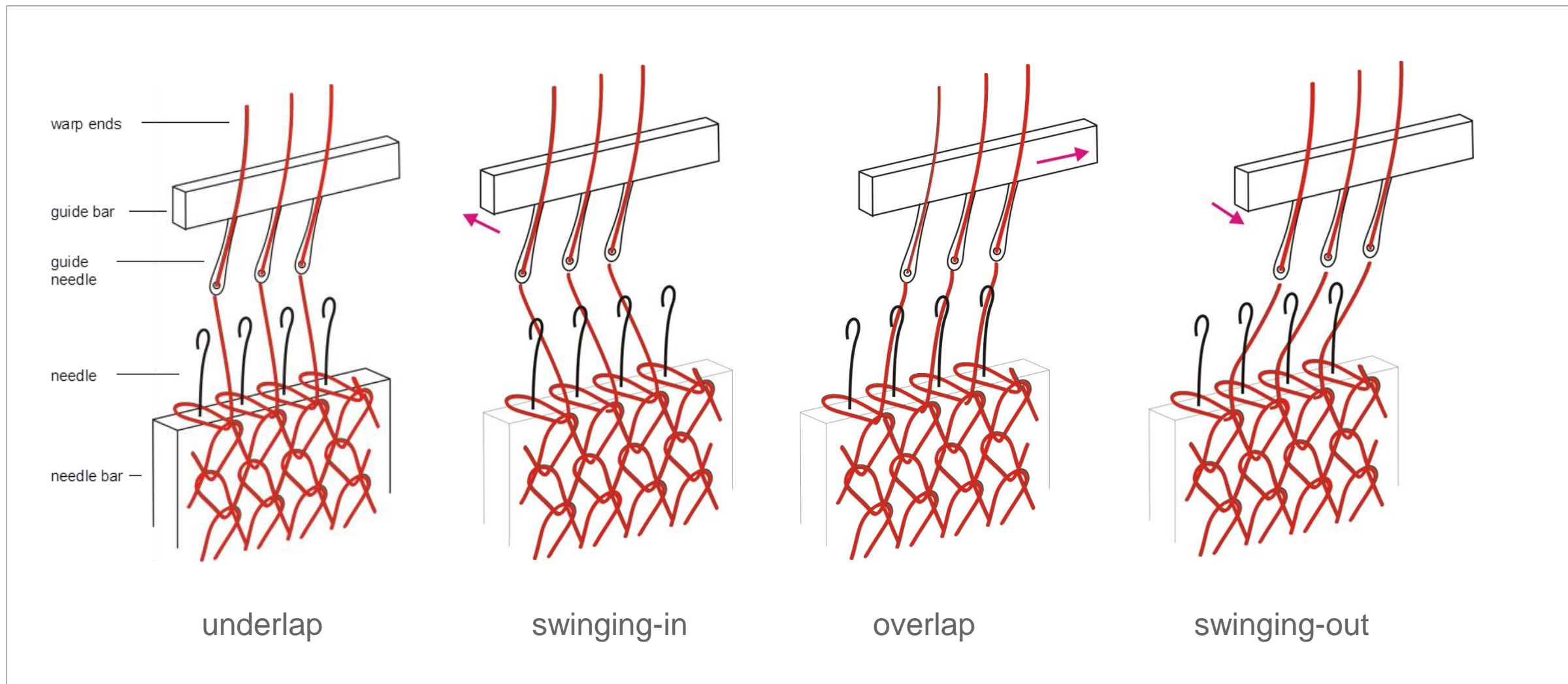


stitch course

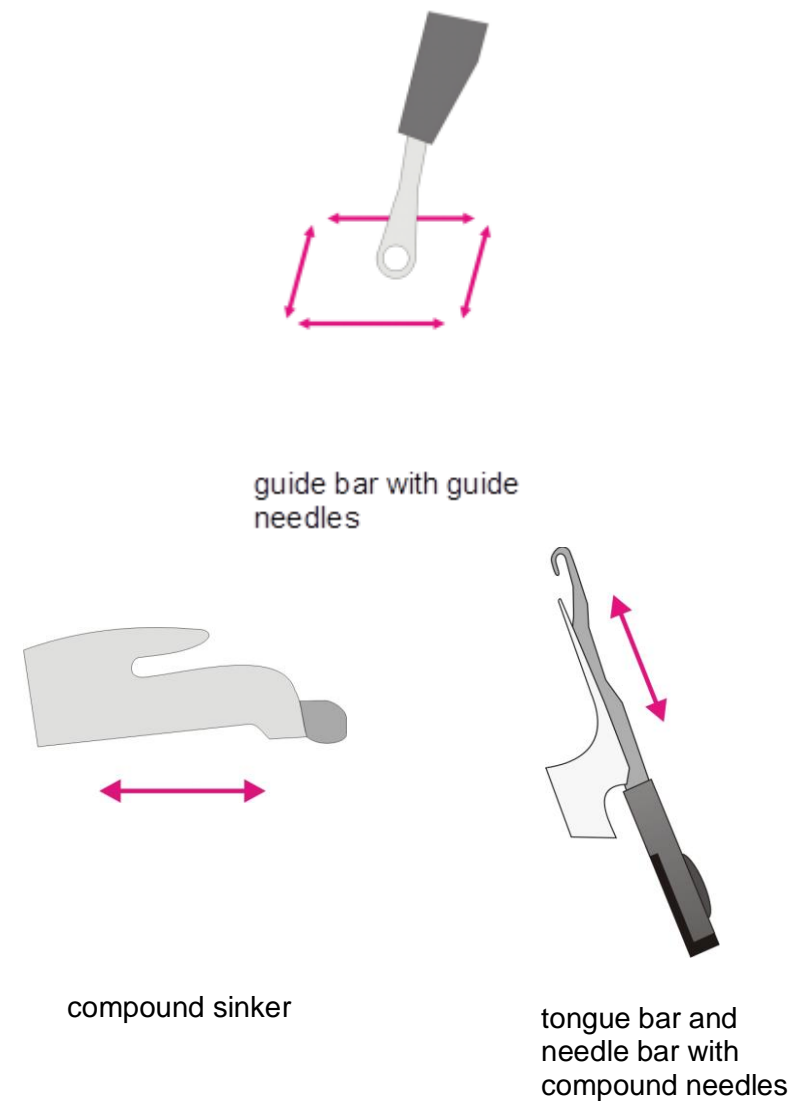
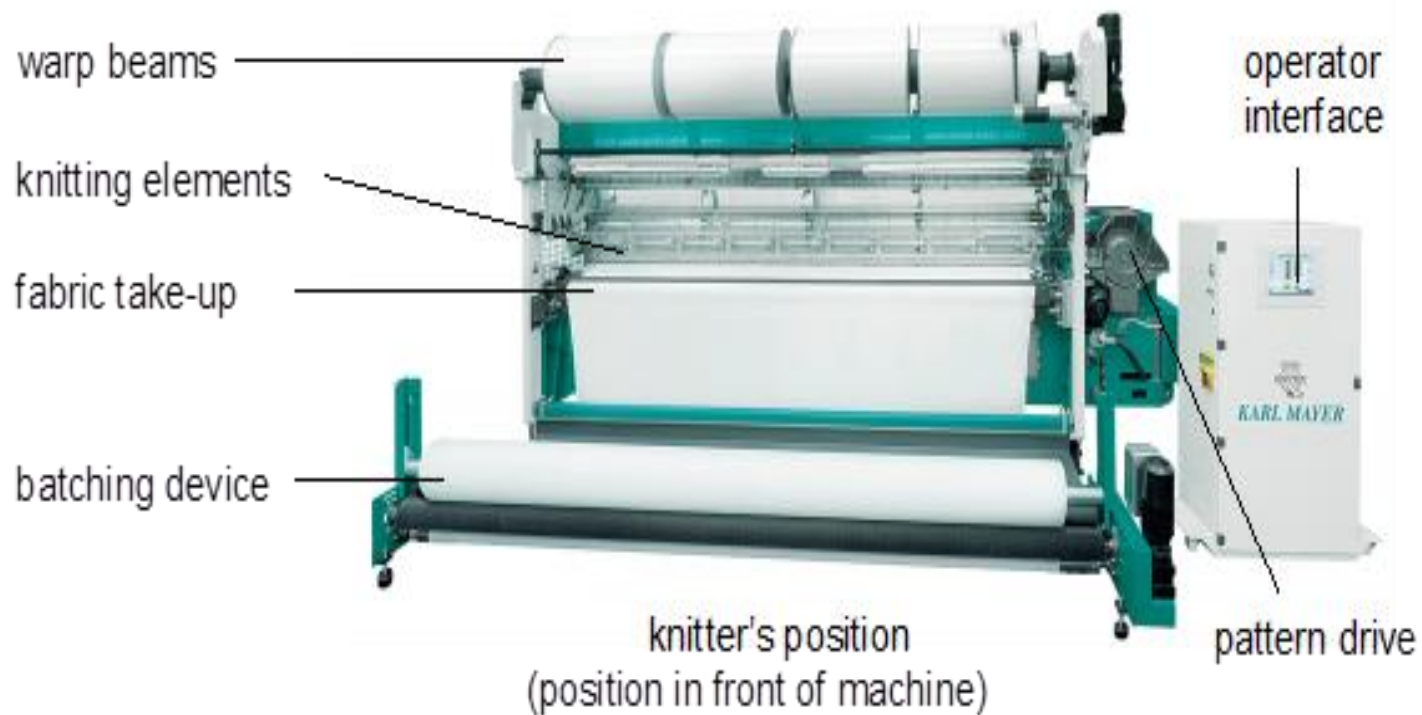


wale

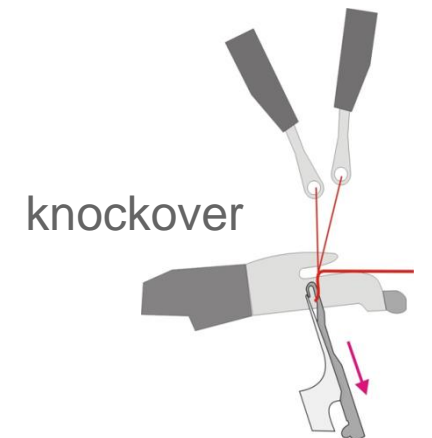
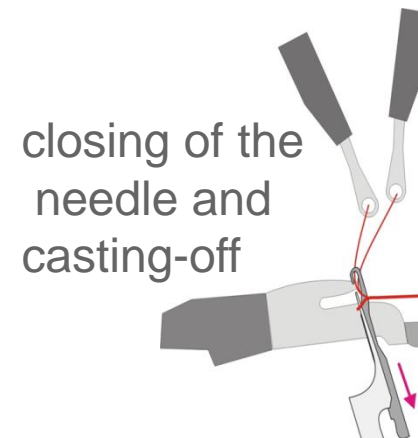
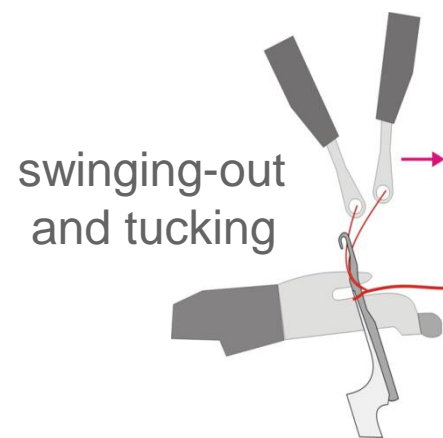
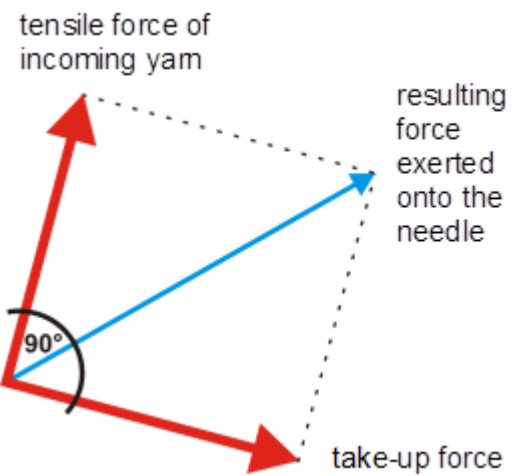
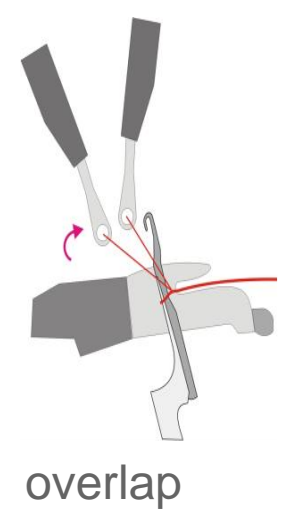
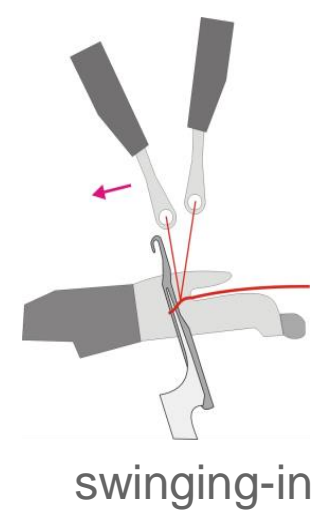
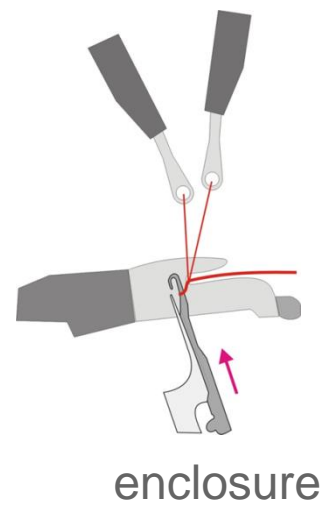
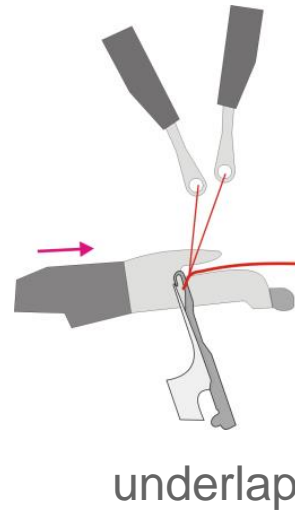
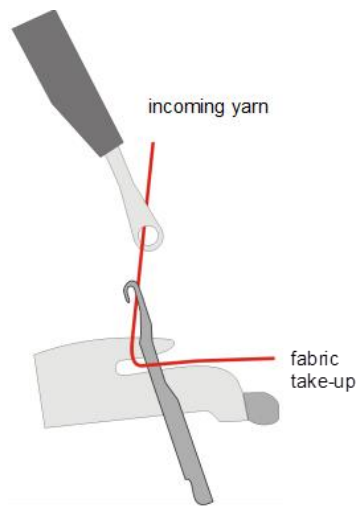
Warp knitting principle (schematic diagram)



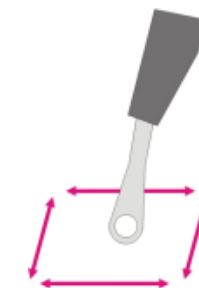
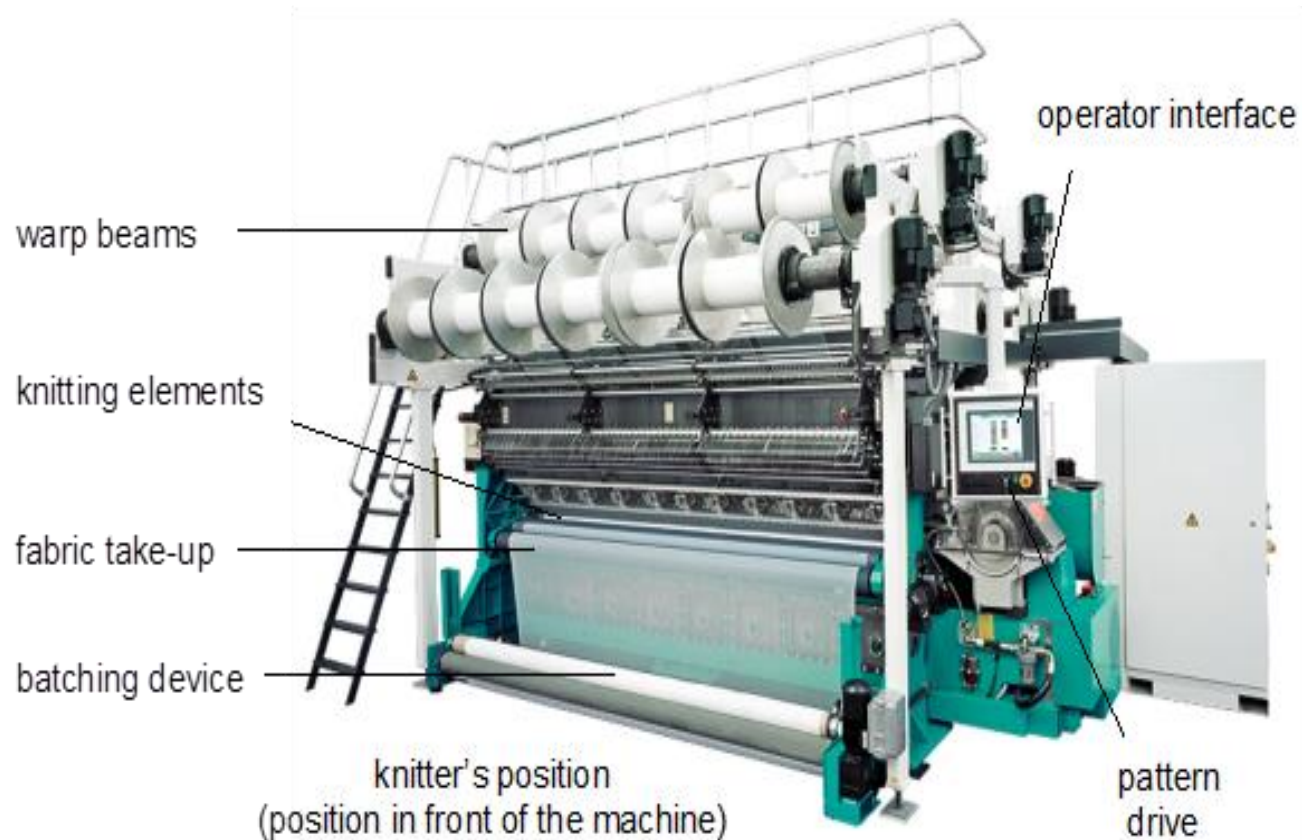
Tricot machine



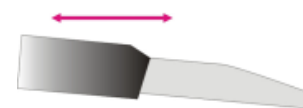
Stitch formation on tricot machines



Single-face Raschel machines



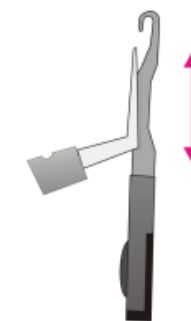
guide bar
with guide
needle



stitch comb bar

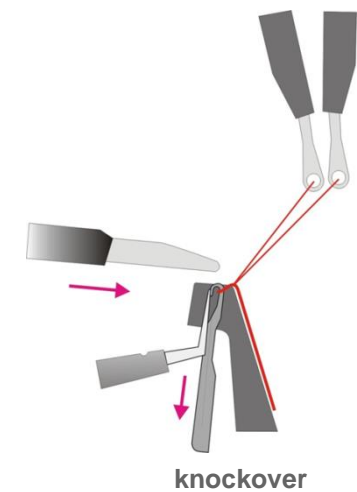
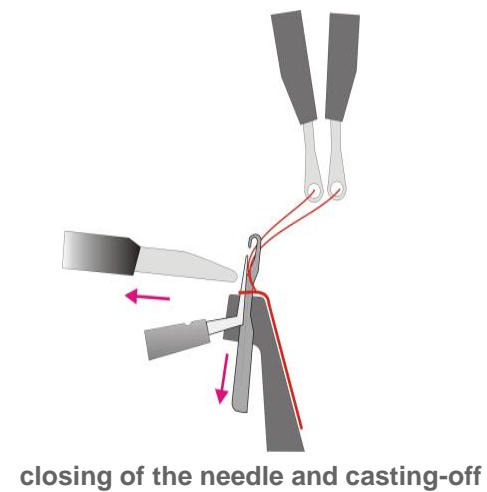
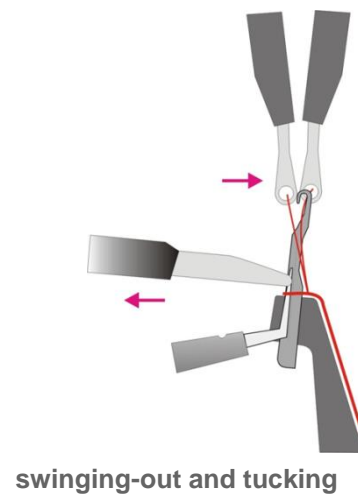
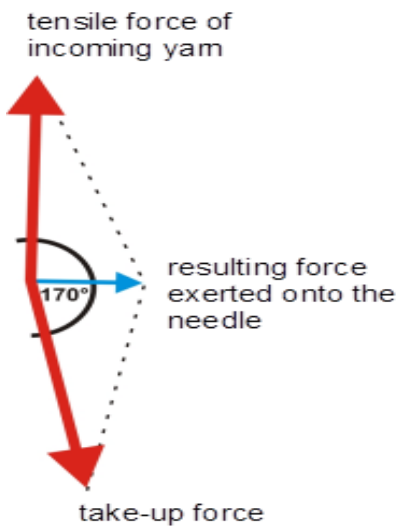
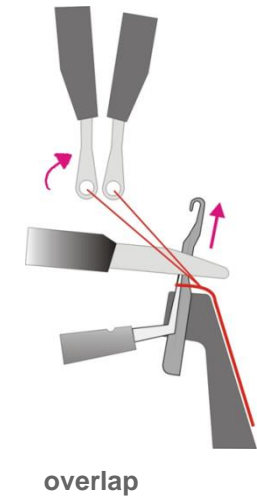
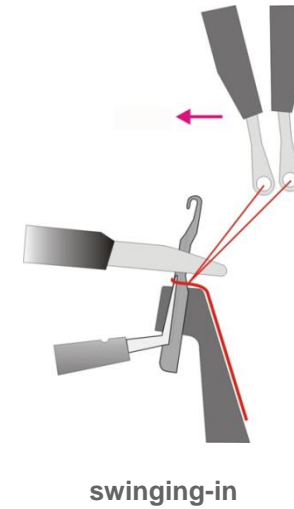
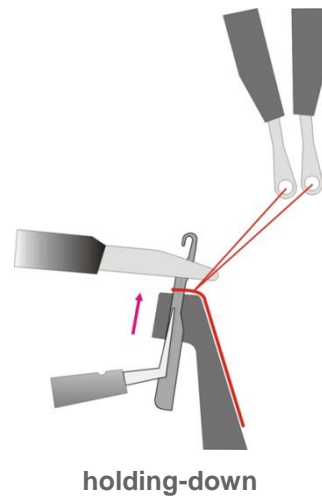
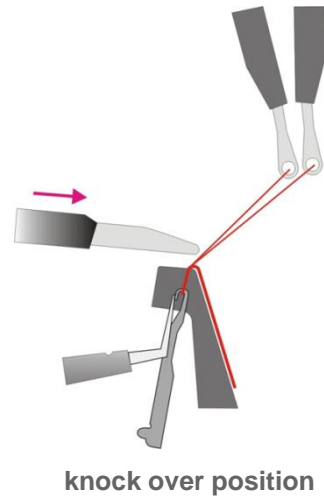
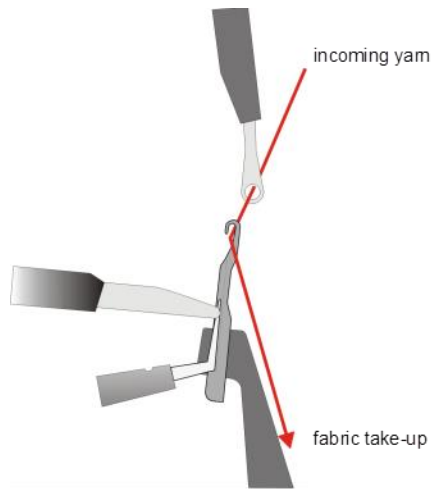


stationary knockover
comb bar



tongue bar and
needle bar with
compound needles

Stitch formation on single-face Raschel machines



Pitch and gauge

E = one english inch = number of needles per 25.4 mm

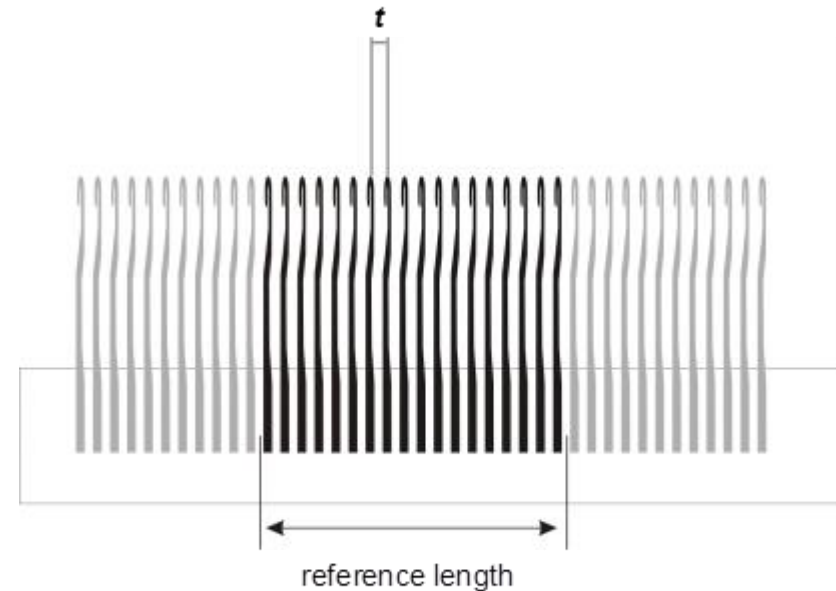
Example:

Gauge E 28 = 28 needles in one inch

Gauge E 8 = 8 needles in one inch

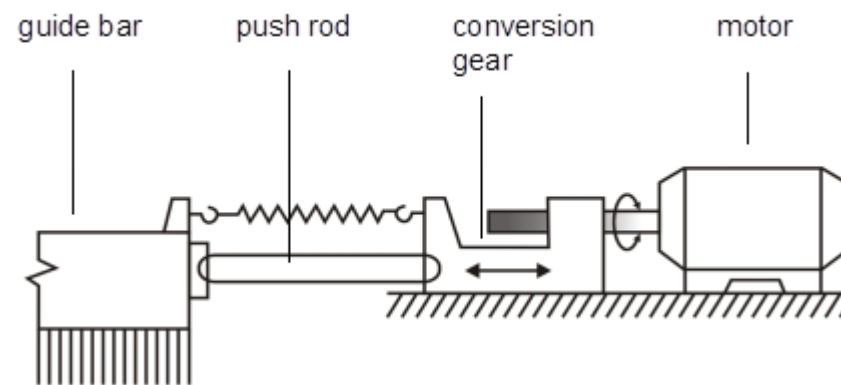
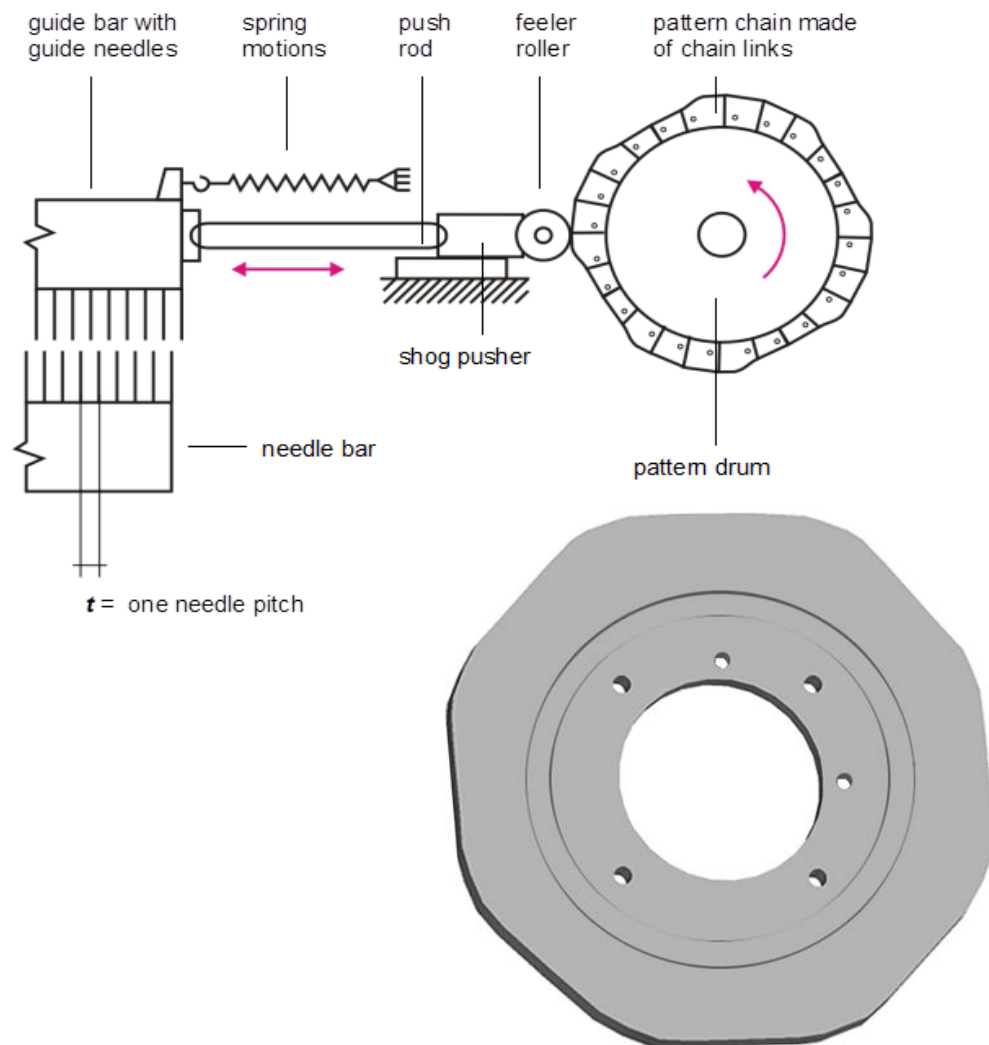
Gauge E 50 = 50 needles in one inch

pitch t = distance between two adjacent needles
with full needling

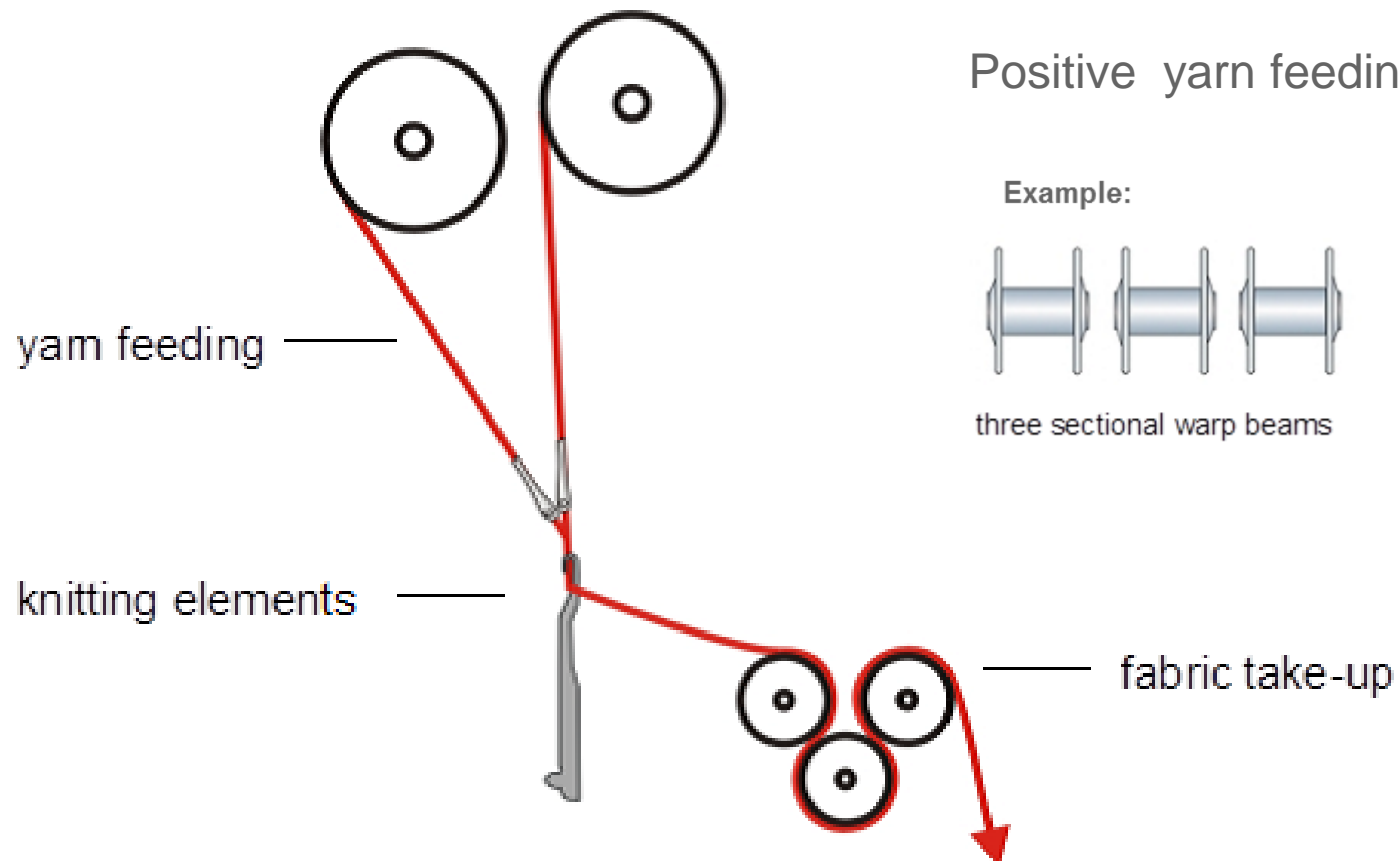


gauge = number of needles per reference
length with full needling

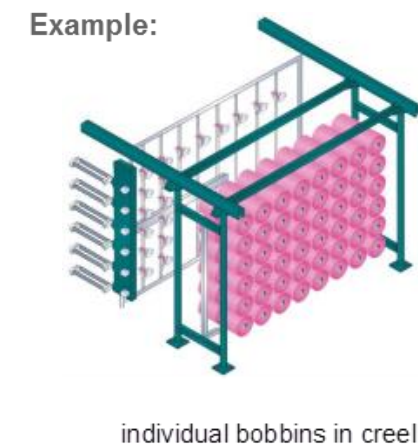
Pattern drives for guide bar control



Yarn feeding and fabric take-up



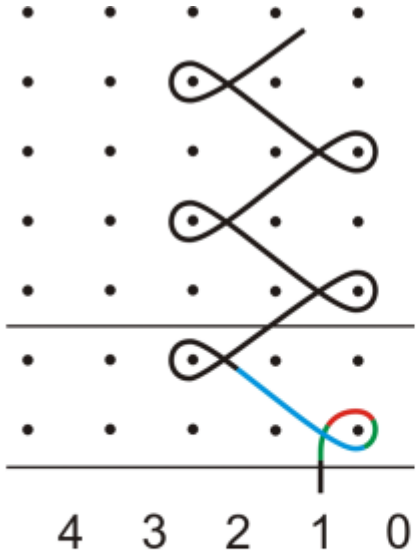
Negative yarn feeding



Stitch constructions and lappings



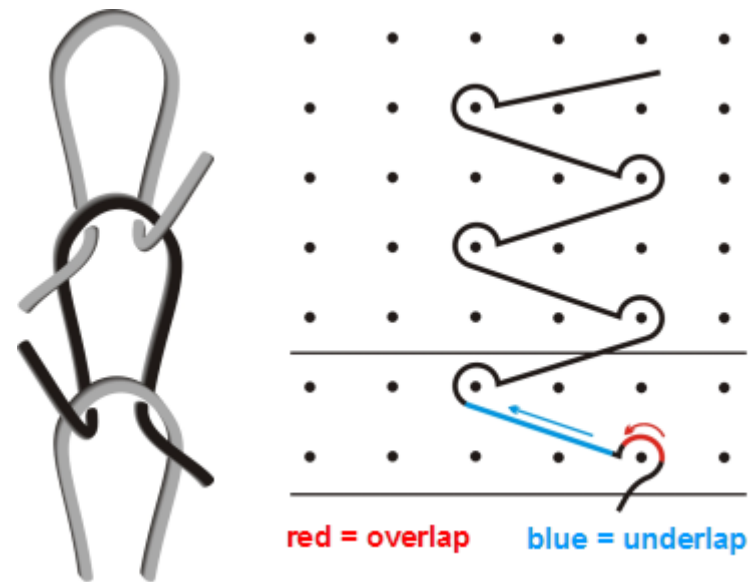
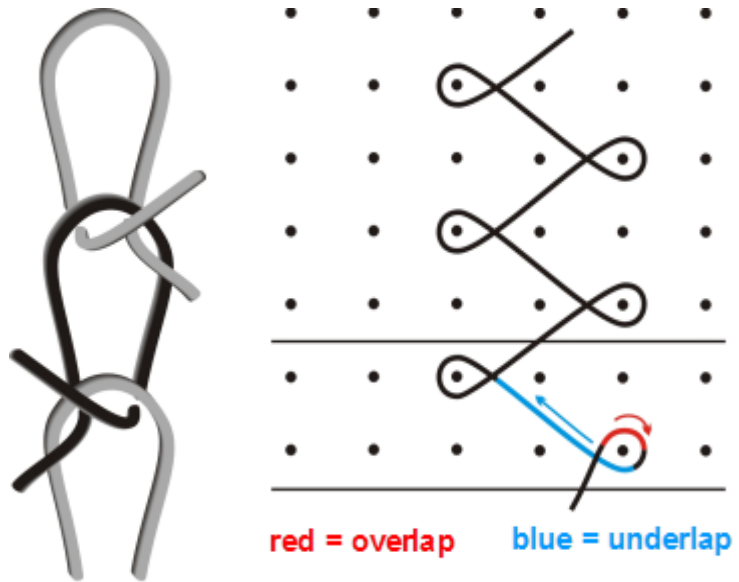
↑
always the same
needle



overlap
swinging-in and swinging-out
underlap

↑
← reading directions

Open and closed stitches



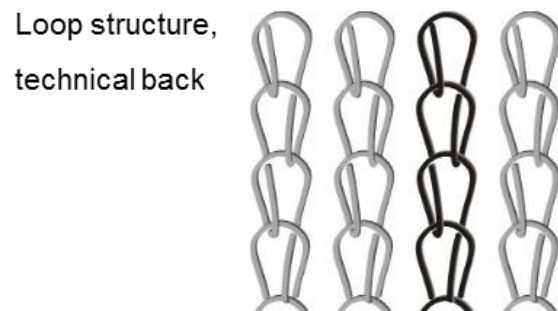
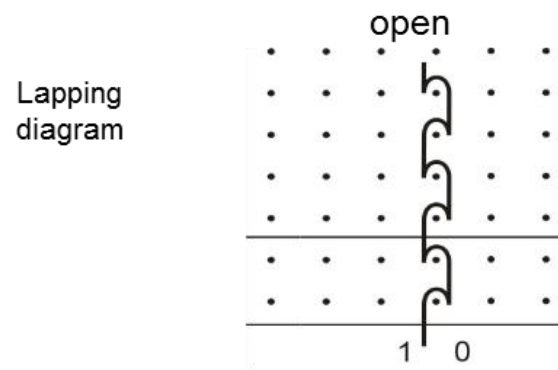
Pillar stitch

When working a pillar stitch, the thread is always lapped around the same needle. Because there is no lateral connection between the wales, no textile fabric will be created. For this reason, pillar stitches are only used in connection with other binding elements.

open loop:

The direction of the feet changes in every course.

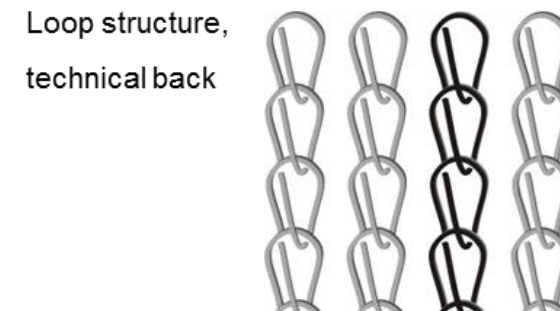
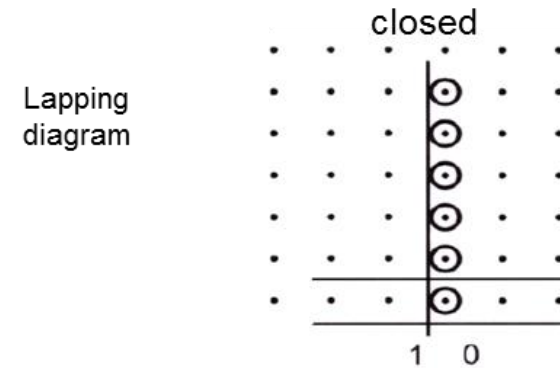
Chain notation 1 – 0 / 0 – 1 //



closed loop:

The feet of the loop always lays in the same direction.

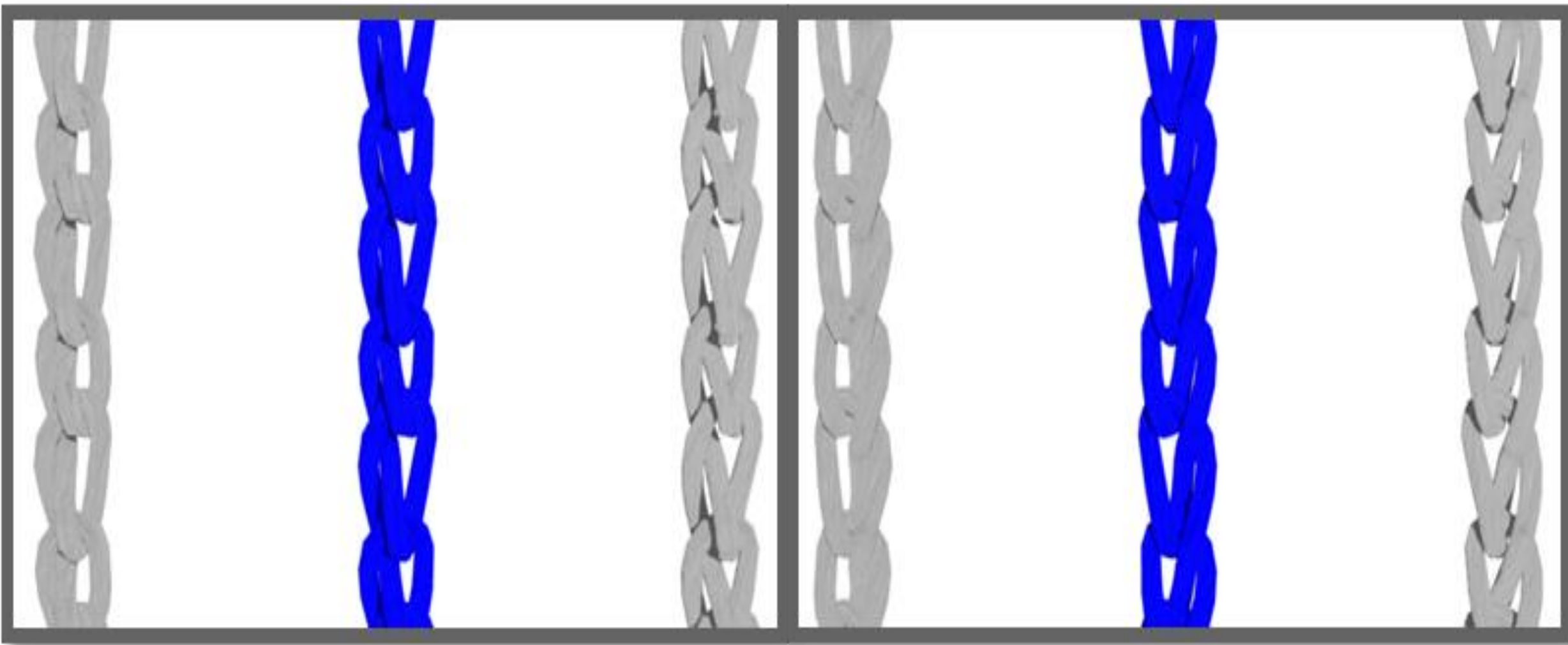
Chain notation 1 – 0 //



Pillar closed

technical back

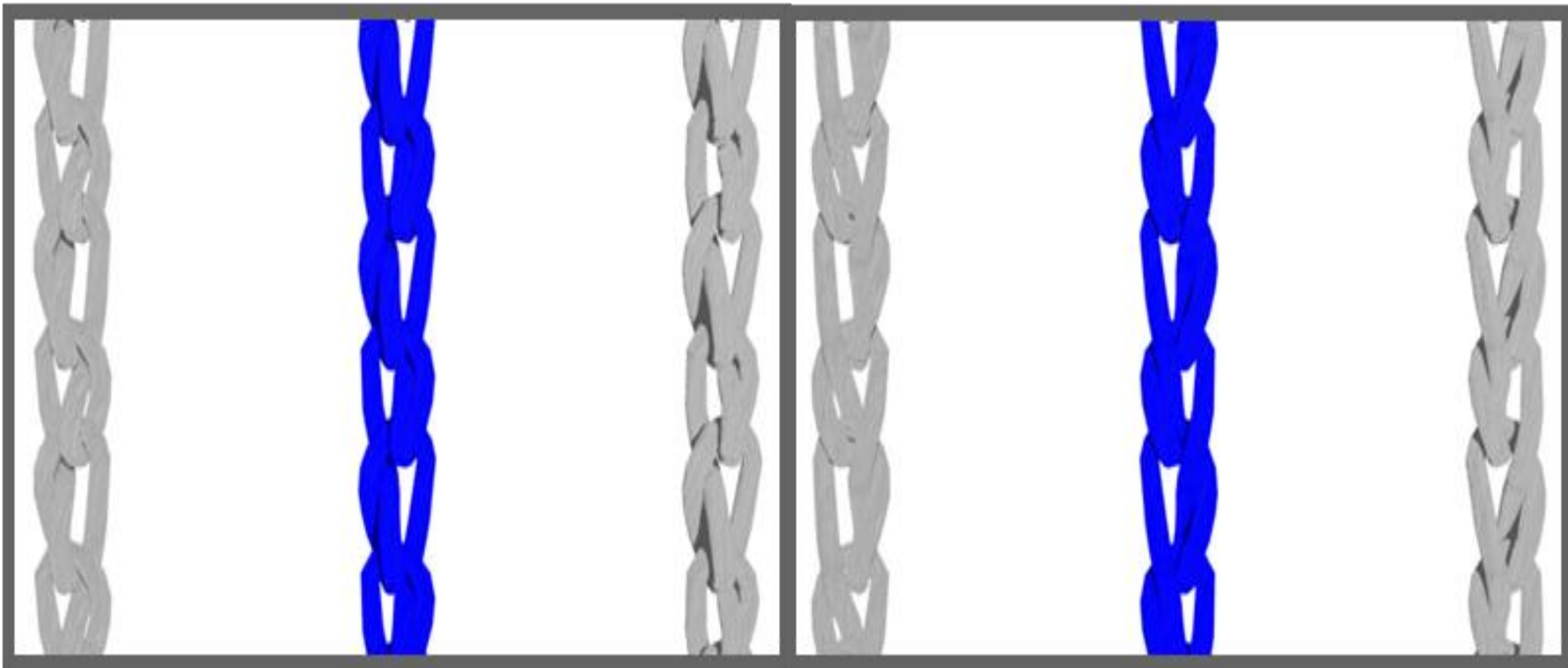
technical face



Pillar open

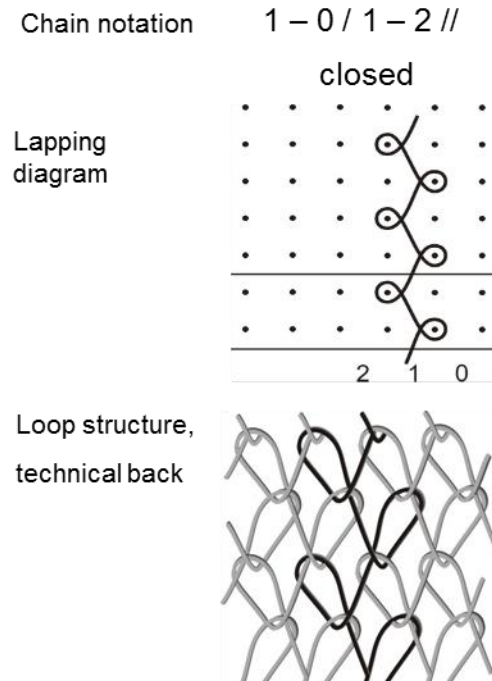
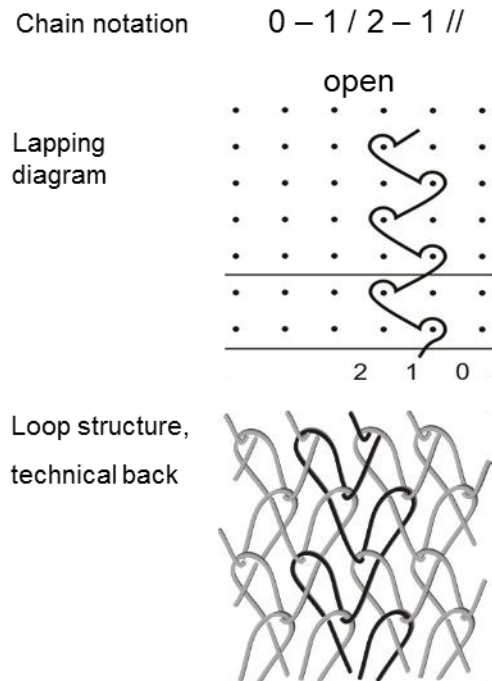
technical back

technical face



1 x 1 lap

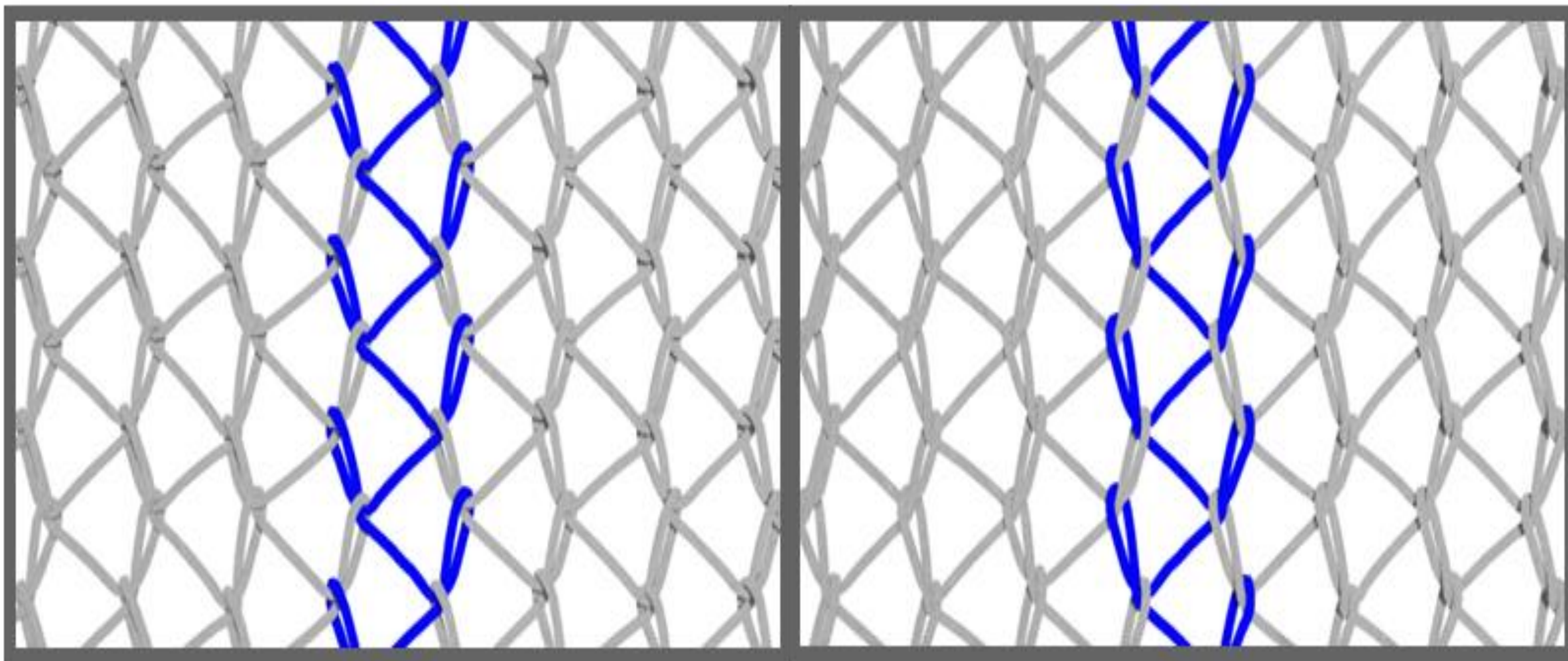
When working a 1 x 1 stitch, also called tricot stitch, the thread is laid alternatively over two adjacent needles. During underlapping a lateral connection between the wales occurs and so a textile construction is produced. Because the underlaps change their direction in every course, the heads of the loops tilt alternatively from the left to the right in every course. This inclination of the loop heads is a characteristic of warp-knitted lappings. The closed 1 x 1 stitch is very light and elastic. However, it is often used in connection with other lappings on tricot machines.



1x1 open

technical back

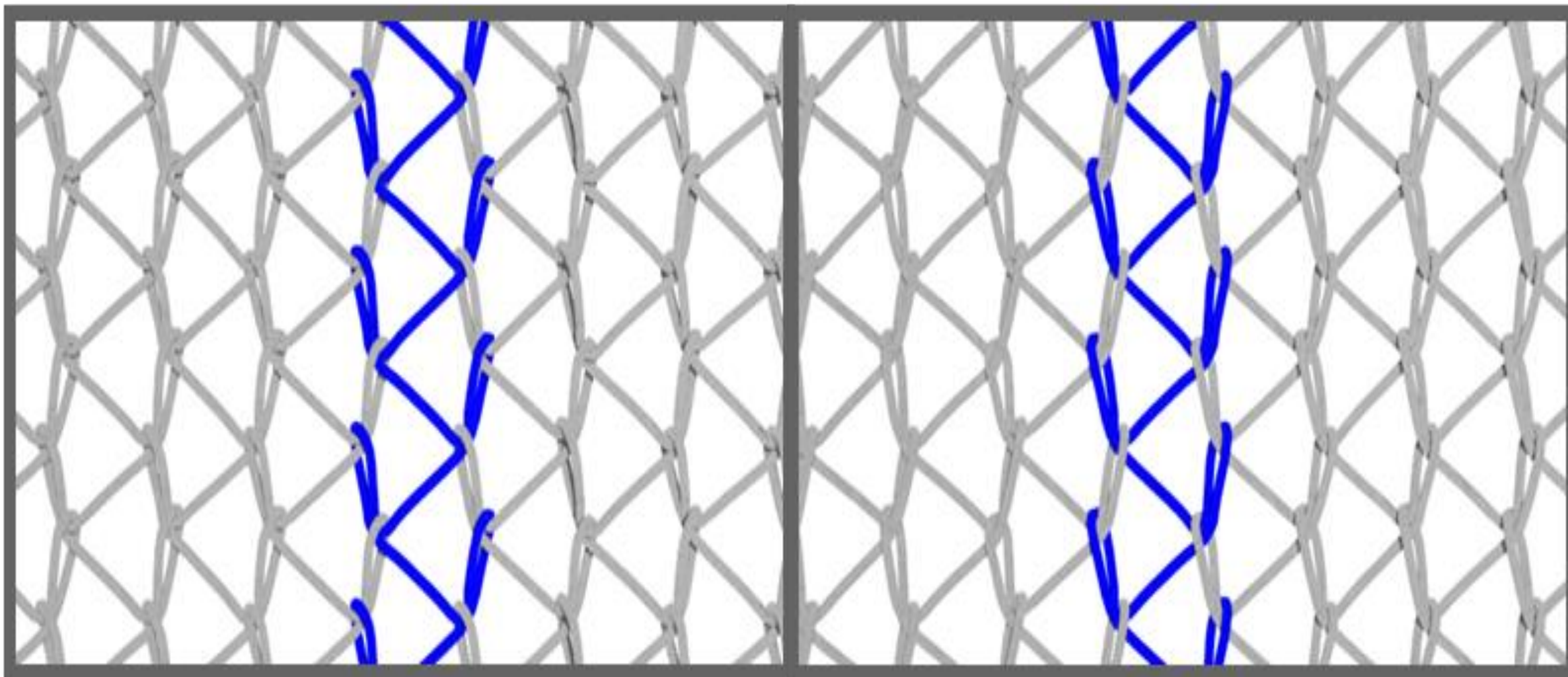
technical face



1x1 closed

technical back

technical face



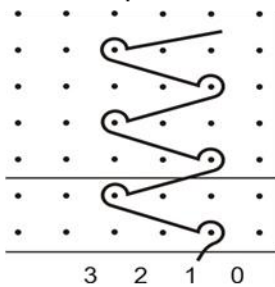
2 x 1 lap

In case of 2 x 1 lap, the underlap also connects the wales to form a textile construction. Compared to 1 x 1 lap, however, the underlap is longer by one pitch, so that the underlap has a somewhat flatter course, resulting in less elasticity of the knitwear in transverse direction. At the same time the article becomes denser and heavier, because of the higher yarn consumption in the underlap.

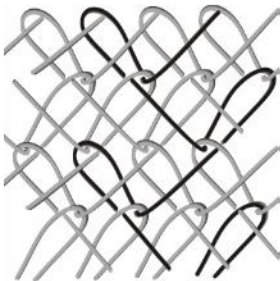
Chain notation 0 – 1 / 3 – 2 //

open

Lapping diagram



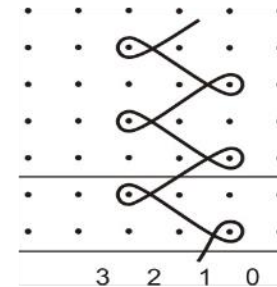
Loop structure, technical back



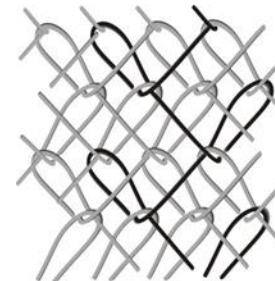
Chain notation 1 – 0 / 2 – 3 //

closed

Lapping diagram



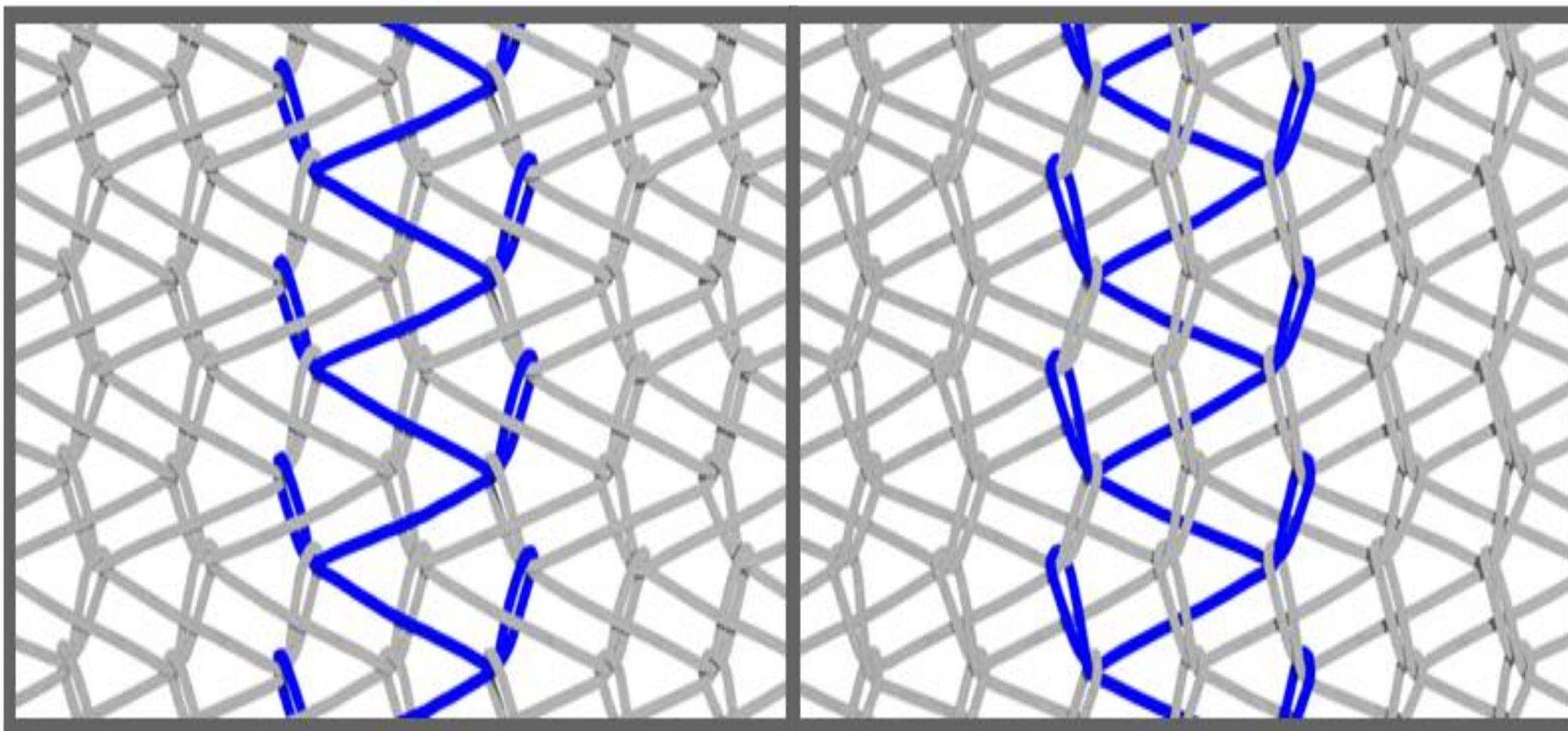
Loop structure, technical back



2 x 1 closed

technical back

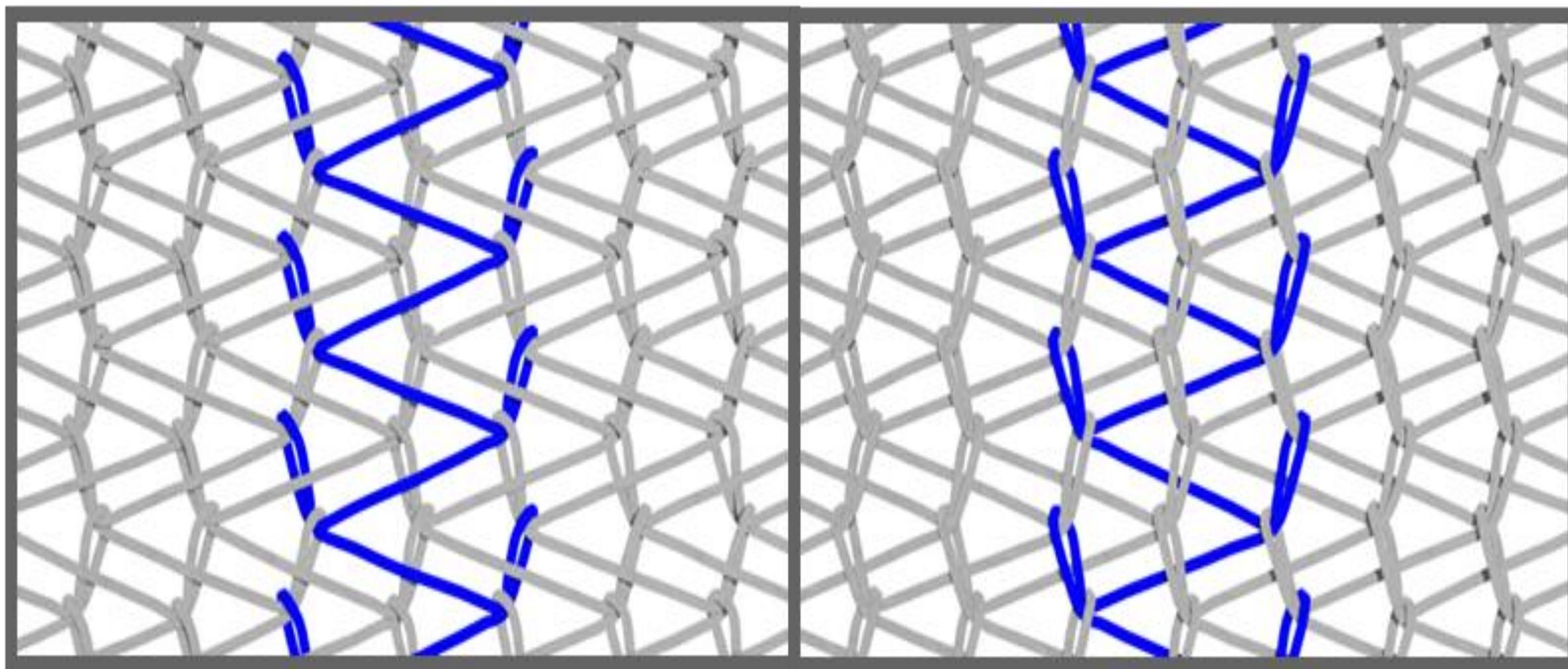
technical face



2 x 1 open

technical back

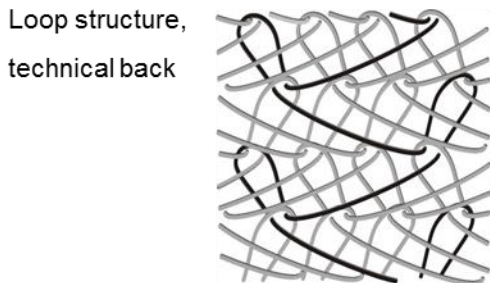
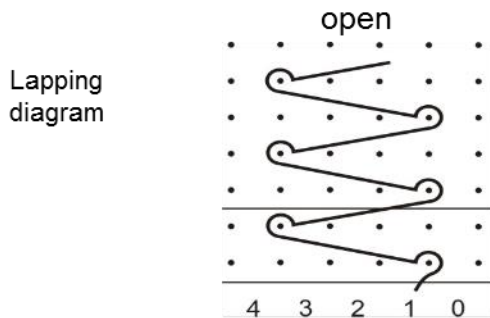
technical face



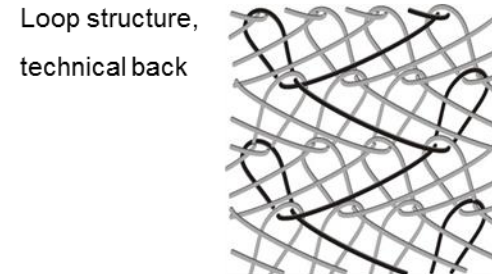
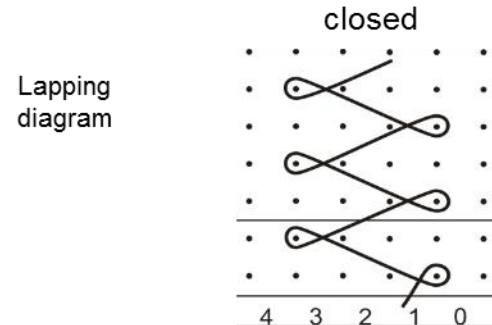
3 x 1 lap

The long underlap of the 3 x 1 lap results in an even higher dimensional stability of the fabric in crosswise direction compared to 2 x 1 lap, also showing a denser and heavier construction. 3 x 1 lap is often combined with pillar stitch offering lengthwise stability, in order to manufacture fabrics showing dimensional stability in lengthwise and crosswise directions. Besides, 3 x 1 laps are frequently combined with 1 x 1 laps, subsequently raising the long underlaps, resulting in a velours-like surface.

Chain notation 0 – 1 / 4 – 3 //



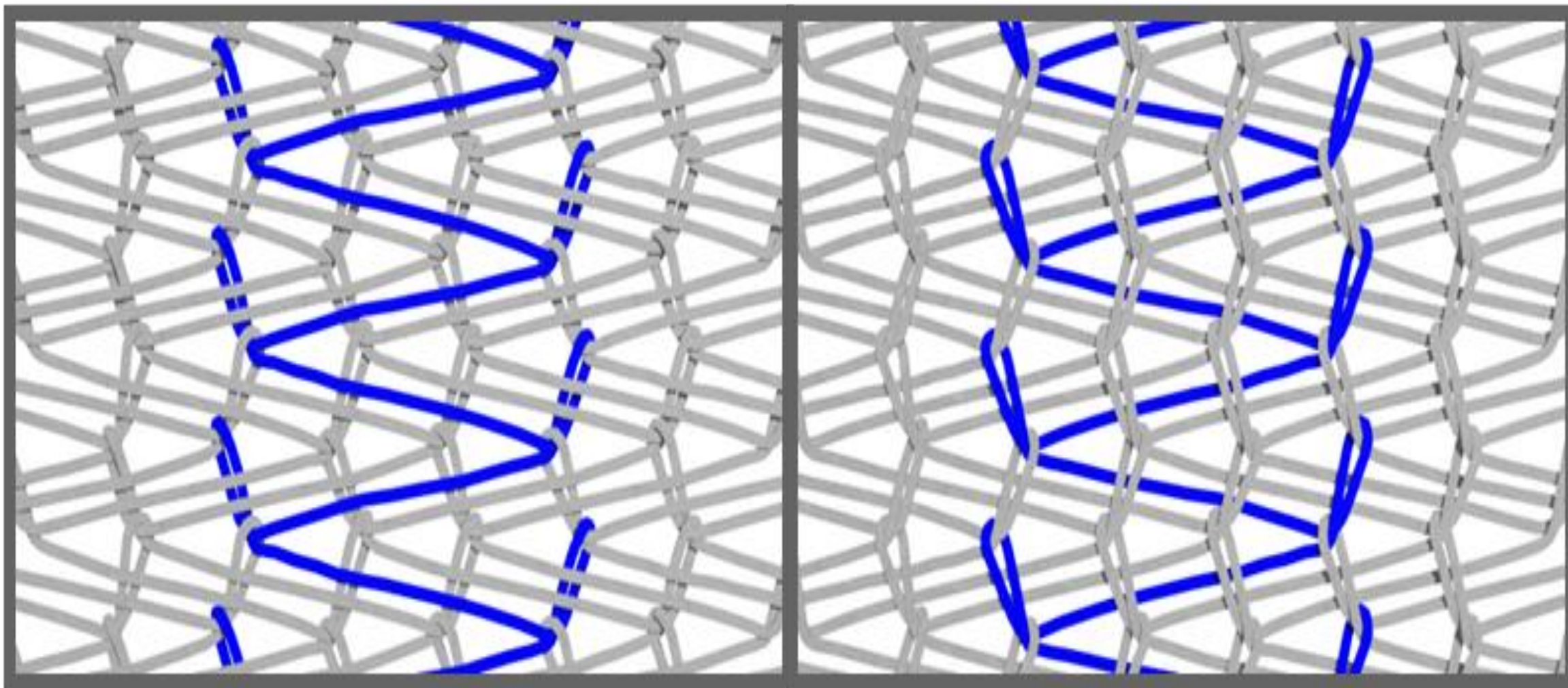
Chain notation 1 – 0 / 3 – 4 //



3x1 closed

technical back

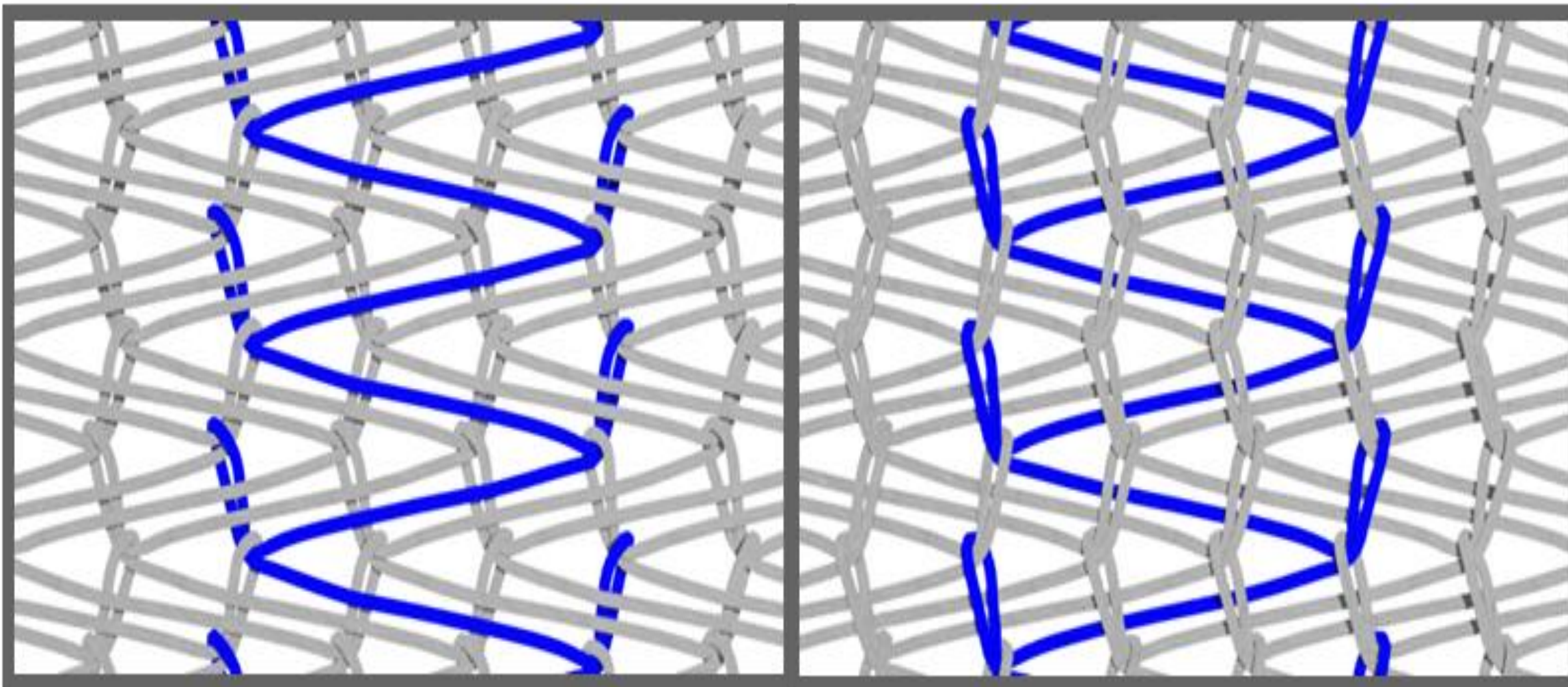
technical face



3x1 open

technical back

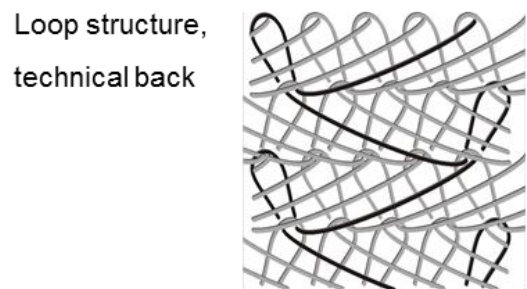
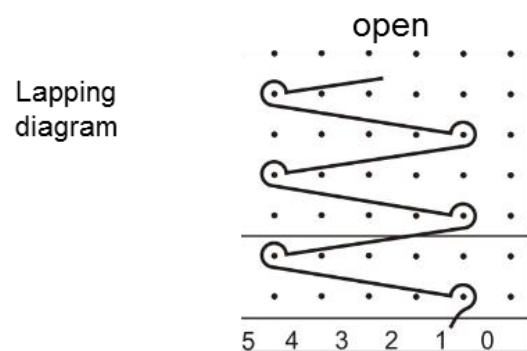
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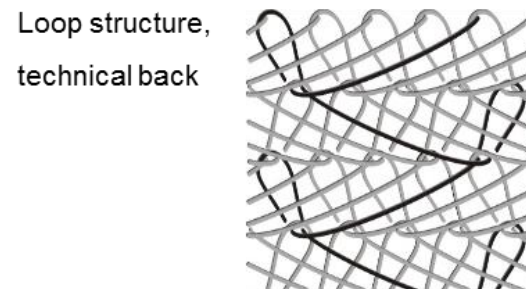
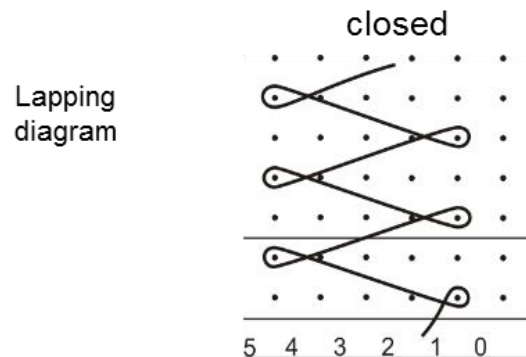
As a result of the long underlap of the 4 x 1 lap, the knitted fabric gets a very high dimensional stability in crosswise direction, also showing an overall very dense and heavy construction.

Besides, all the lappings showing an underlap under more than four needles, are respectively called 5 x 1 lap, 6 x 1 lap, ect.

Chain notation 0 – 1 / 5 – 4 //

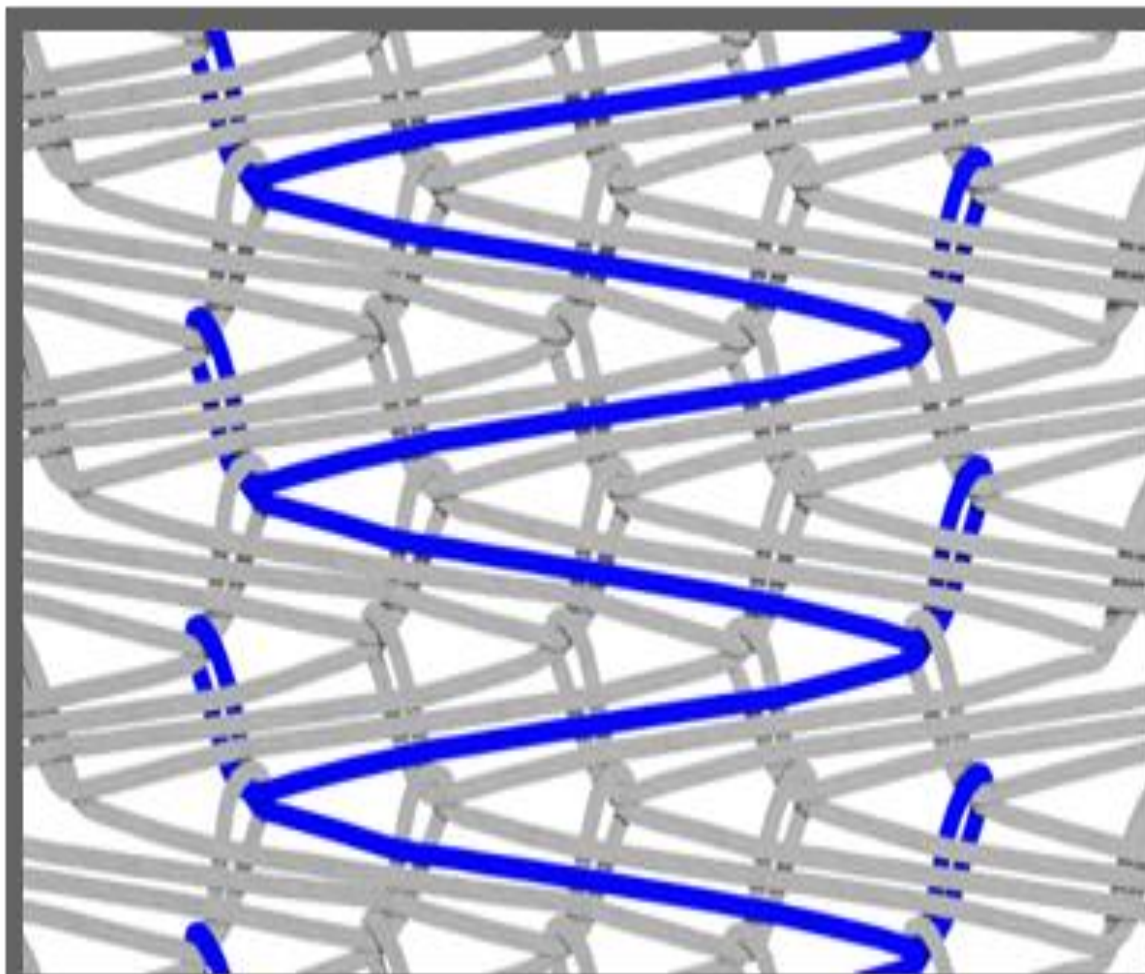


Chain notation 1 – 0 / 4 – 5 //

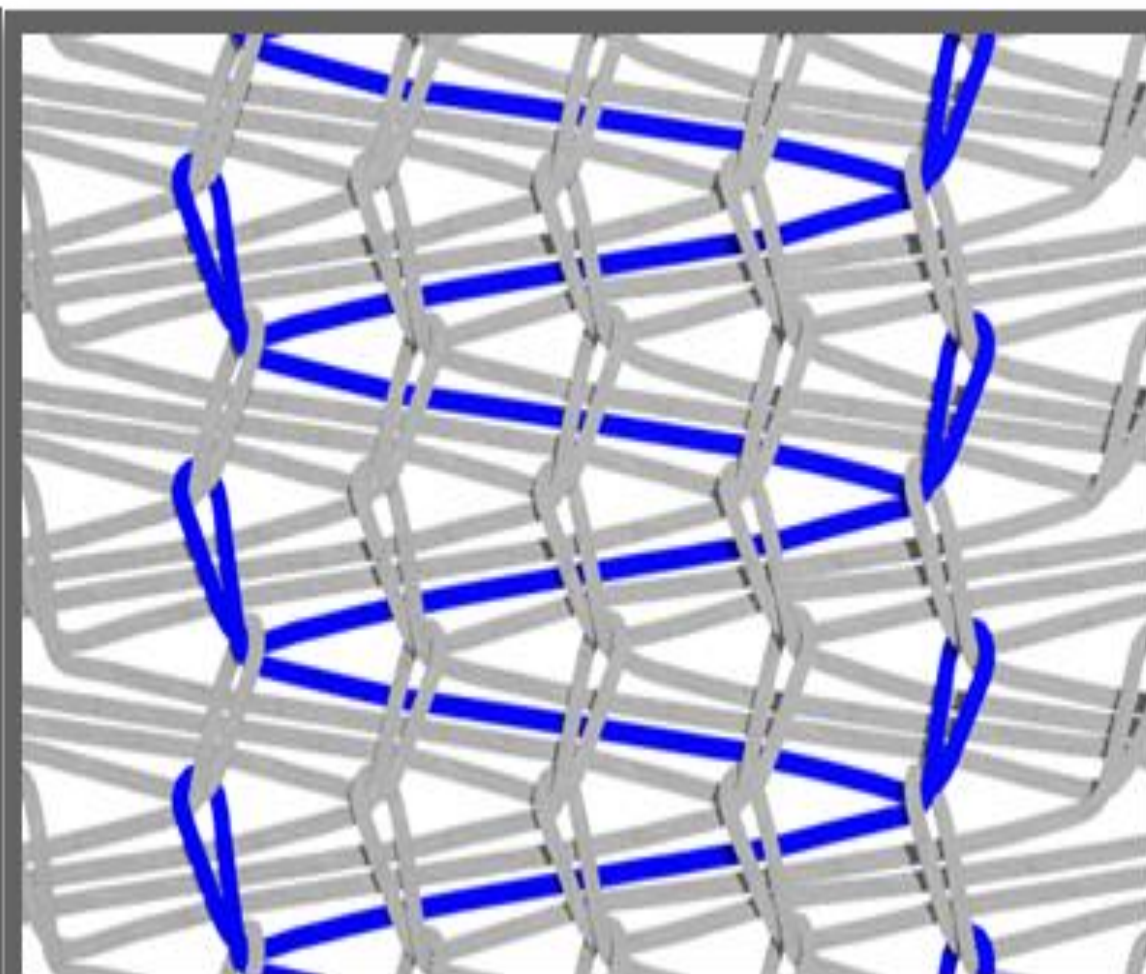


4 x 1 closed

technical back



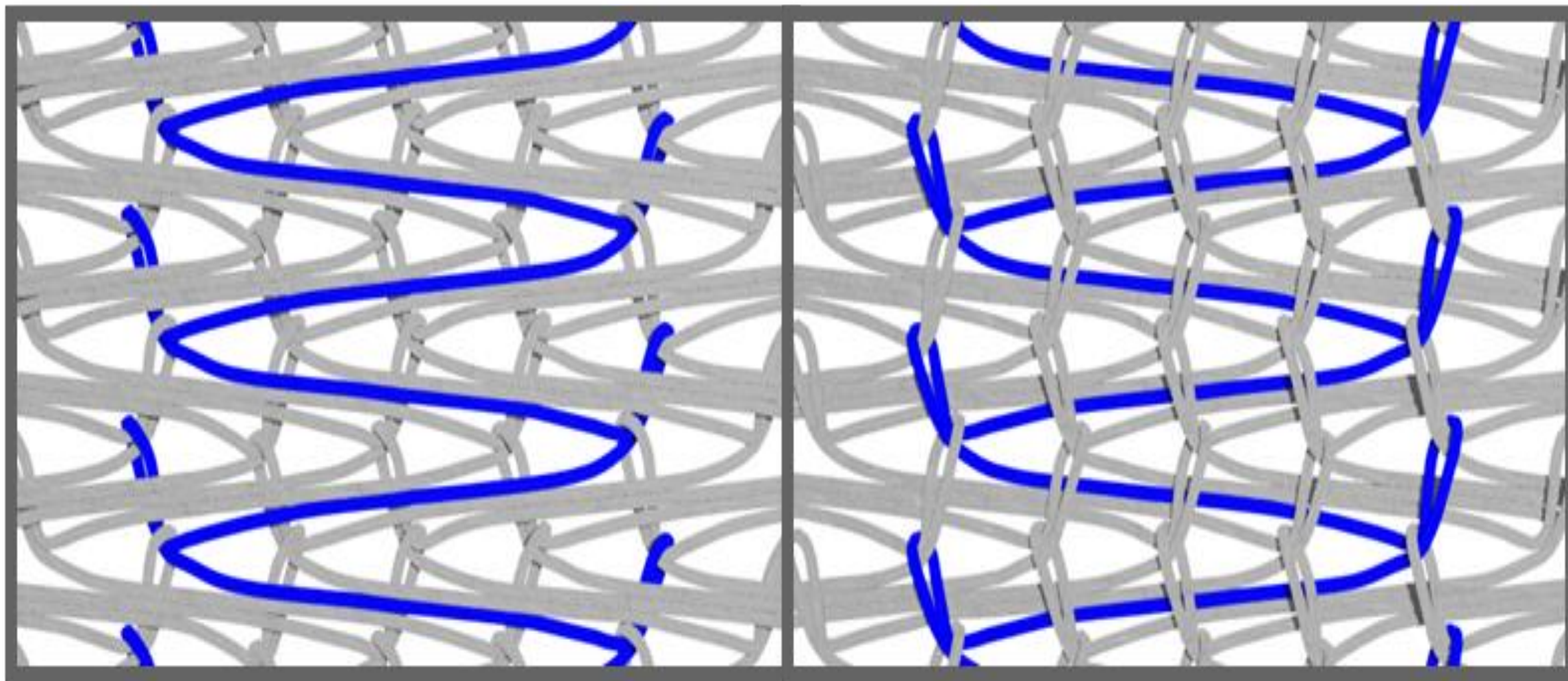
technical face



4 x 1 open

technical back

technical face

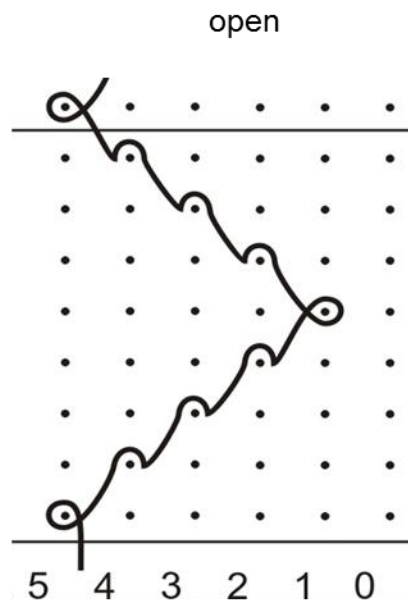


4-row open atlas

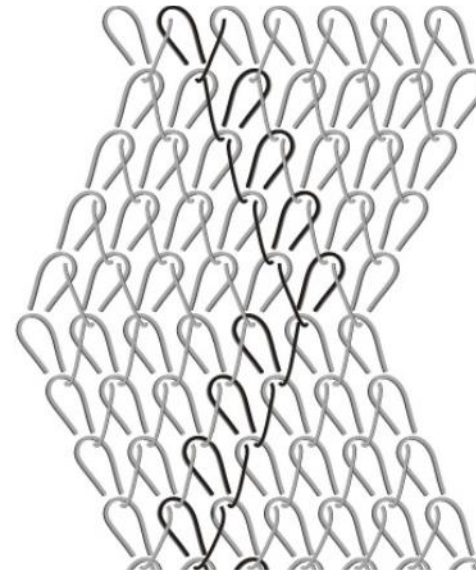
As far as the atlas lap is concerned, the guide bar lays the same yarn continuously in one direction into the adjacent needle. The direction is only changed after having reached the desired number of rising stitch courses, after a reversing course. Then the stitch formation returns to the starting needle. The number of rising stitch courses plus one reversing course indicates the „rows" of the atlas lap, which must always be specified, e.g. 4-row atlas. The repeat length is twice the height of the “rows”, this means that the 4-row atlas construction has a repeat length of 8 stitch courses.

Chain notation 4 – 5 / 4 – 3 / 3 – 2 / 2 – 1 / 1 – 0 / 1 – 2 / 2 – 3 / 3 – 4 //

Lapping diagram



Loop structure,
technical back

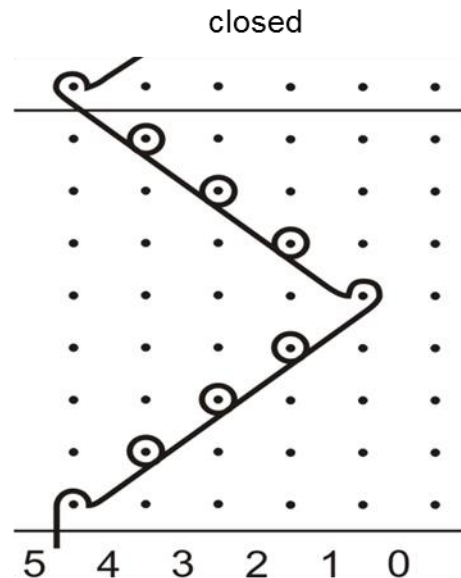


4-row closed atlas

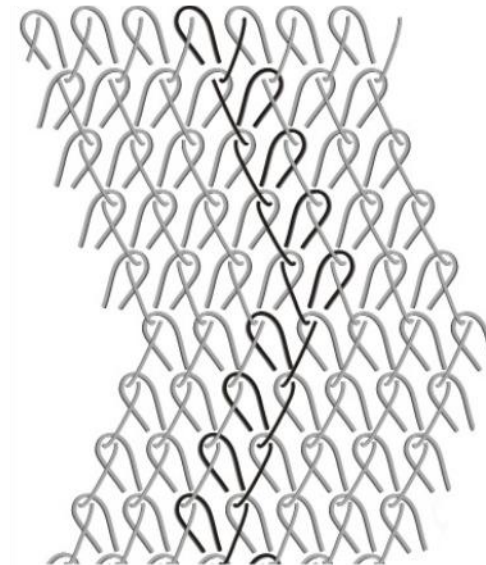
With “closed” atlas, the continuous stitch courses (i.e. the rising stitch courses) are closed, only the reversing course is open. Whereas with “open” atlas, the rising stitch courses are open, and the reversing course is closed. The change in direction after several stitch courses results in a cross-striped fabric appearance. A most striking zigzag pattern is formed when using yarns of different colours.

Chain notation 5 – 4 / 3 – 4 / 2 – 3 / 1 – 2 / 0 – 1 / 2 – 1 / 3 – 2 / 4 – 3 //

Lapping diagram



Loop structure, technical back

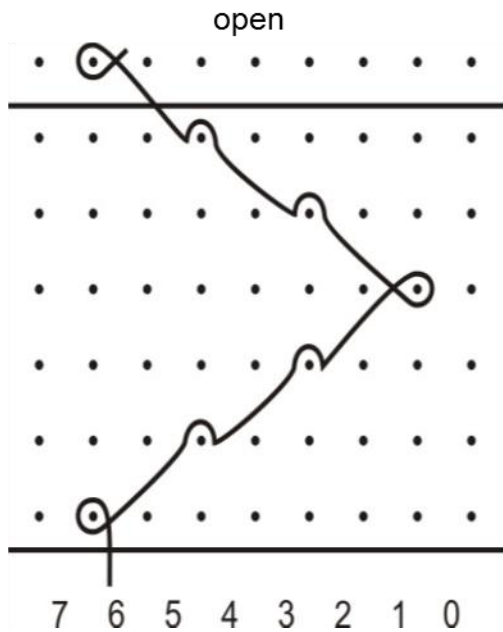


3-row back lapped open atlas

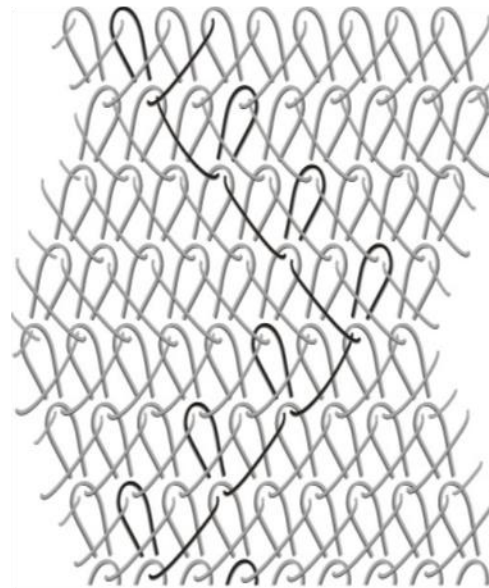
Owing to the longer underlap, this back-lapped atlas produces a denser and heavier warp-knitted fabric, showing higher crosswise dimensional stability than the normal atlas construction.

Chain notation 6 – 7 / 5 – 4 / 3 – 2 / 1 – 0 / 2 – 3 / 4 – 5 //

Lapping diagram



Loop structure, technical back

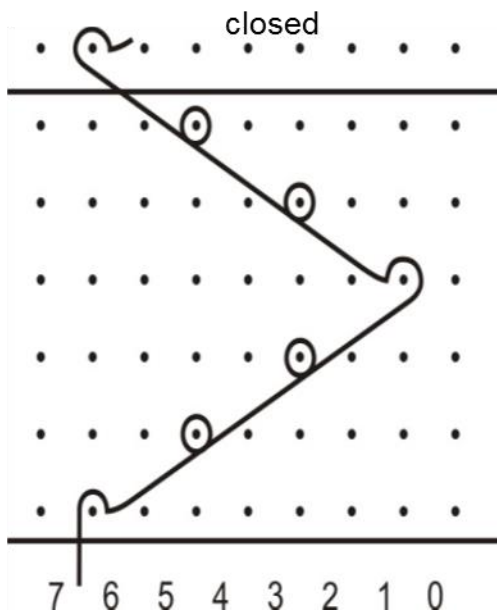


3-row back lapped closed atlas

When making back-lapped atlas, the guide bar continuously places the same yarn in one direction into the next needle but one, e.g. into the first, third and fifth needles, etc.

Chain notation $7 - 6 / 4 - 5 / 2 - 3 / 0 - 1 / 3 - 2 / 5 - 4 //$

Lapping diagram



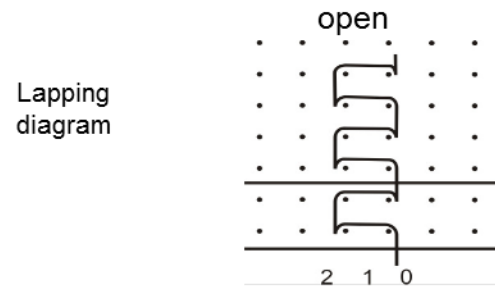
Loop structure, technical back



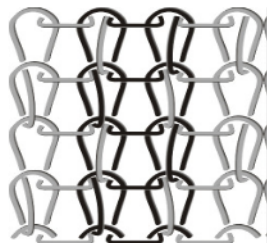
Two needle overlap

All the previously discussed lappings can be modified by means of the two-needle overlap, which is formed as follows: within one stitch course the guide bar places the same yarn (in the overlap) over two adjacent needles. A distinctive feature of this process is that two neighbouring stitches of one and the same stitch course are formed from the same yarn. During this cycle, however, the knitting elements and the yarns are subjected to considerable stress (strain). Moreover, the manufacture of these constructions is more demanding than that of other lappings, so that the two needle overlap is seldom used.

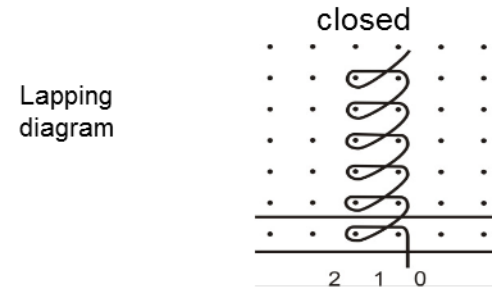
Chain notation $0 - 2 / 2 - 0 //$



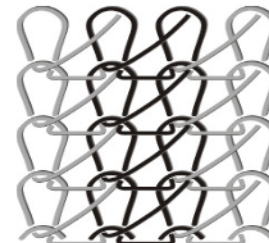
Loop structure,
technical back



Chain notation $0 - 2 //$



Loop structure,
technical back

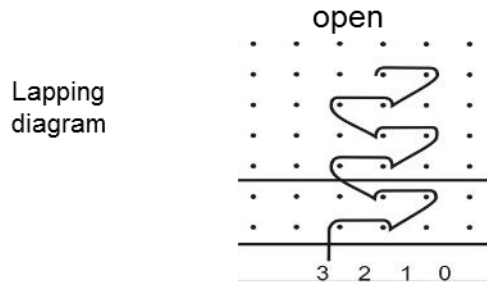


1 x 2 lap

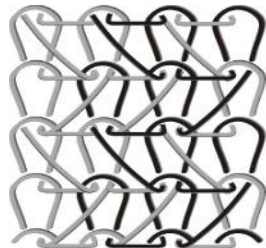
For making 1 x 2 lap, the guide bar alternately places the same yarn around two needles each, i.e. around the first and second needles, and in the next stitch course: around the second and third needles. 1 x 2 means underlap under 1 needle and overlap over 2 needles.

Two stitches are formed on one needle. The yarn consumption is higher than in case of the normal 1 x 1 lap. But a warp-knitted fabric can already be made with one guide bar only.

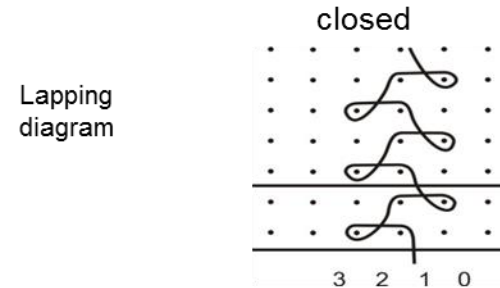
Chain notation 3 – 1 / 0 – 2 //



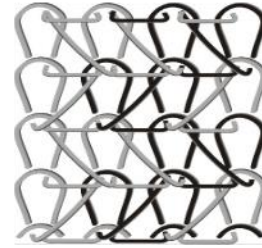
Loop structure, technical back



Chain notation 1 – 3 / 2 – 0 //

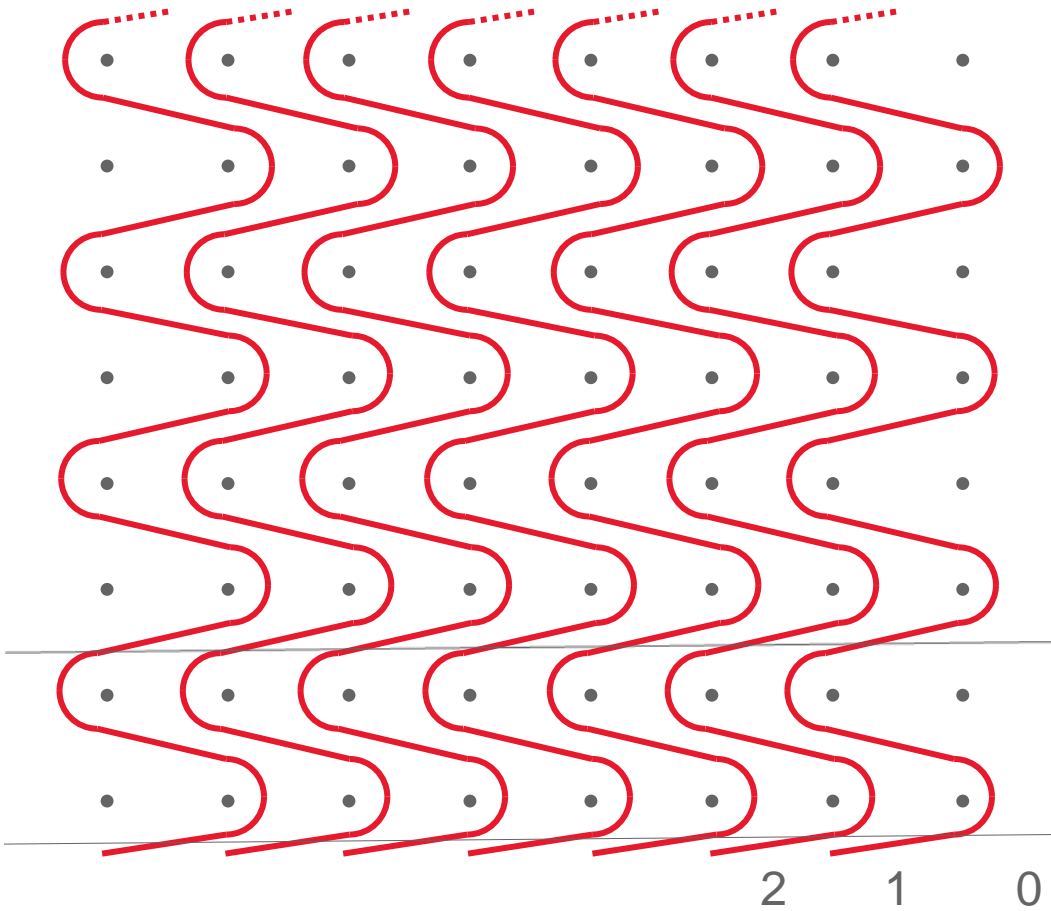


Loop structure, technical back

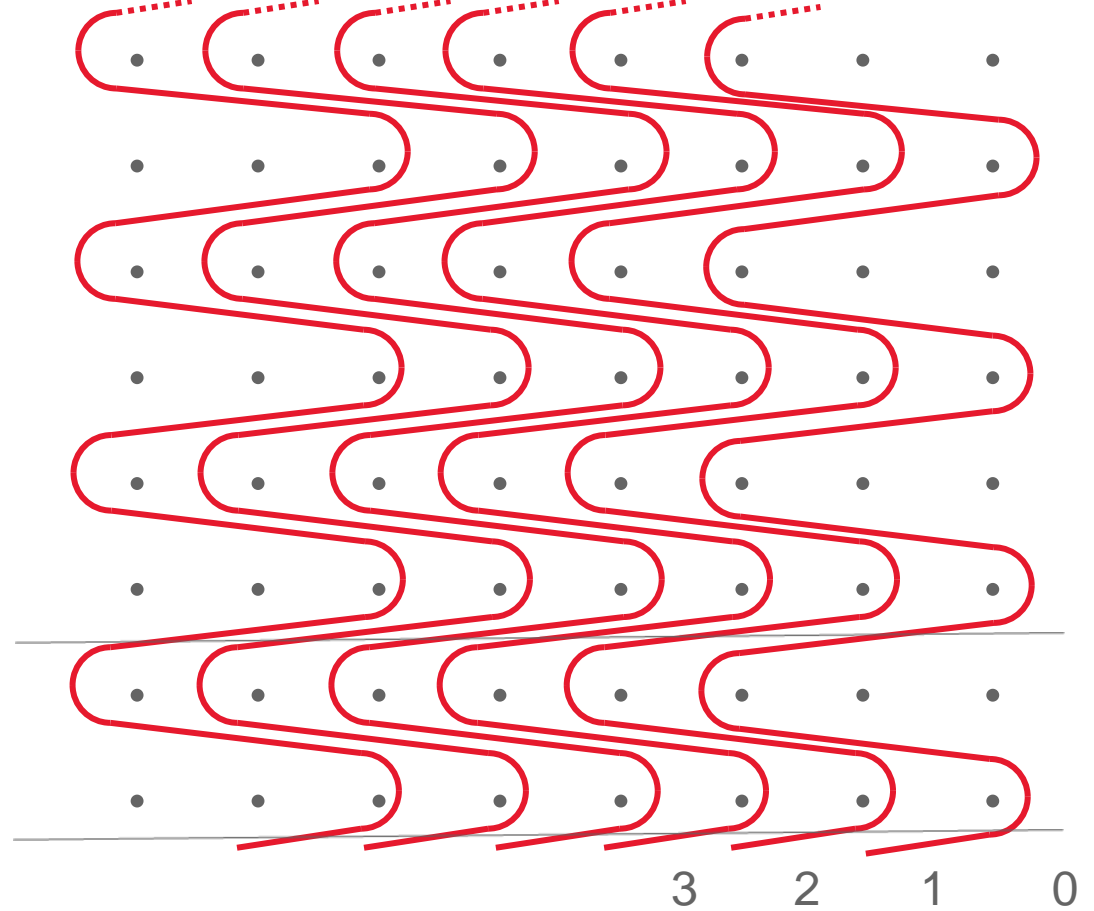


Inlay

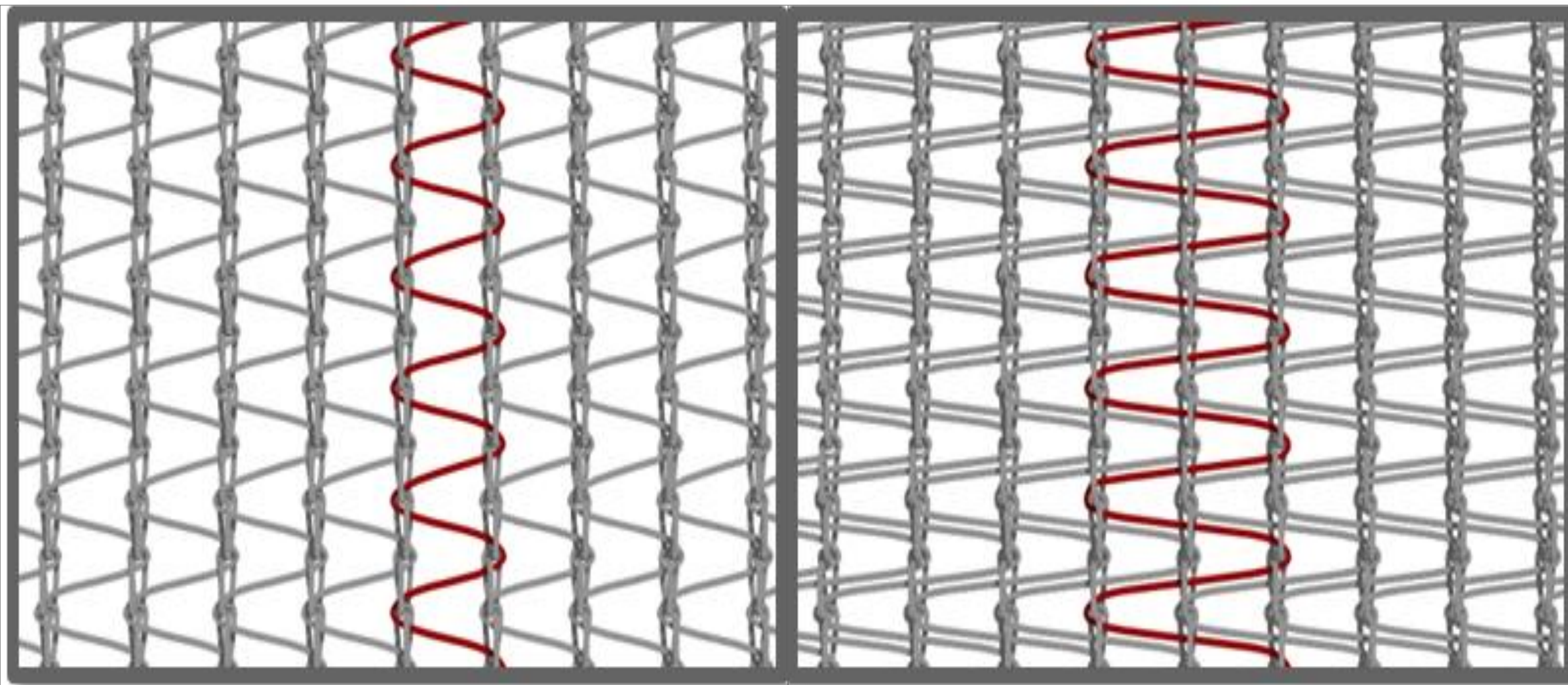
Lapping: 0-0 / 2-2 //
Repeat length 2



Lapping: 0-0 / 3-3 //
Repeat length 2

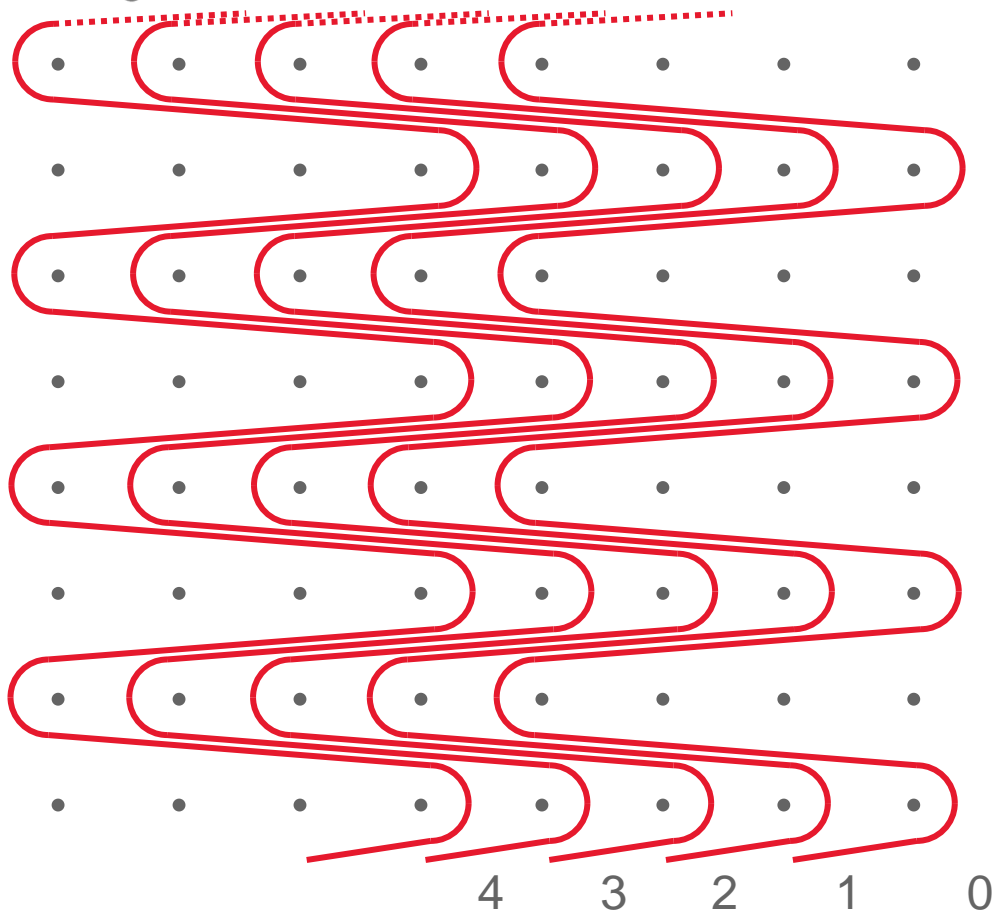


Inlay

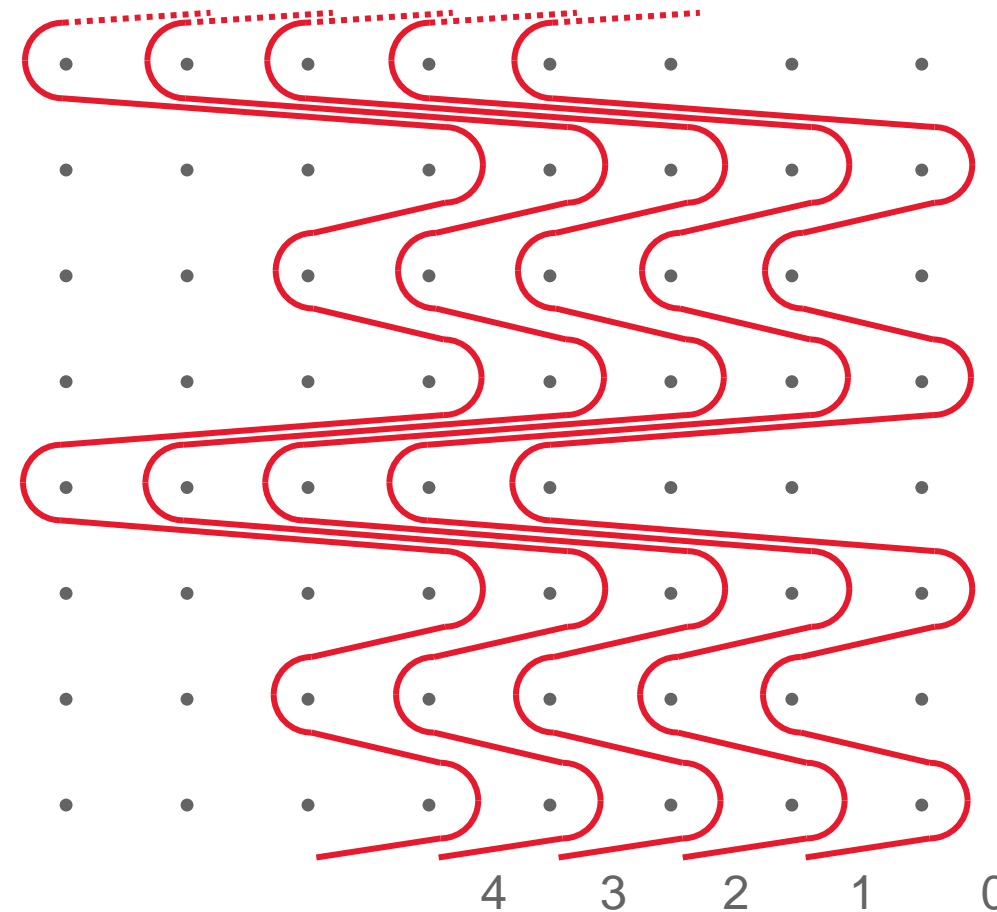


Inlay

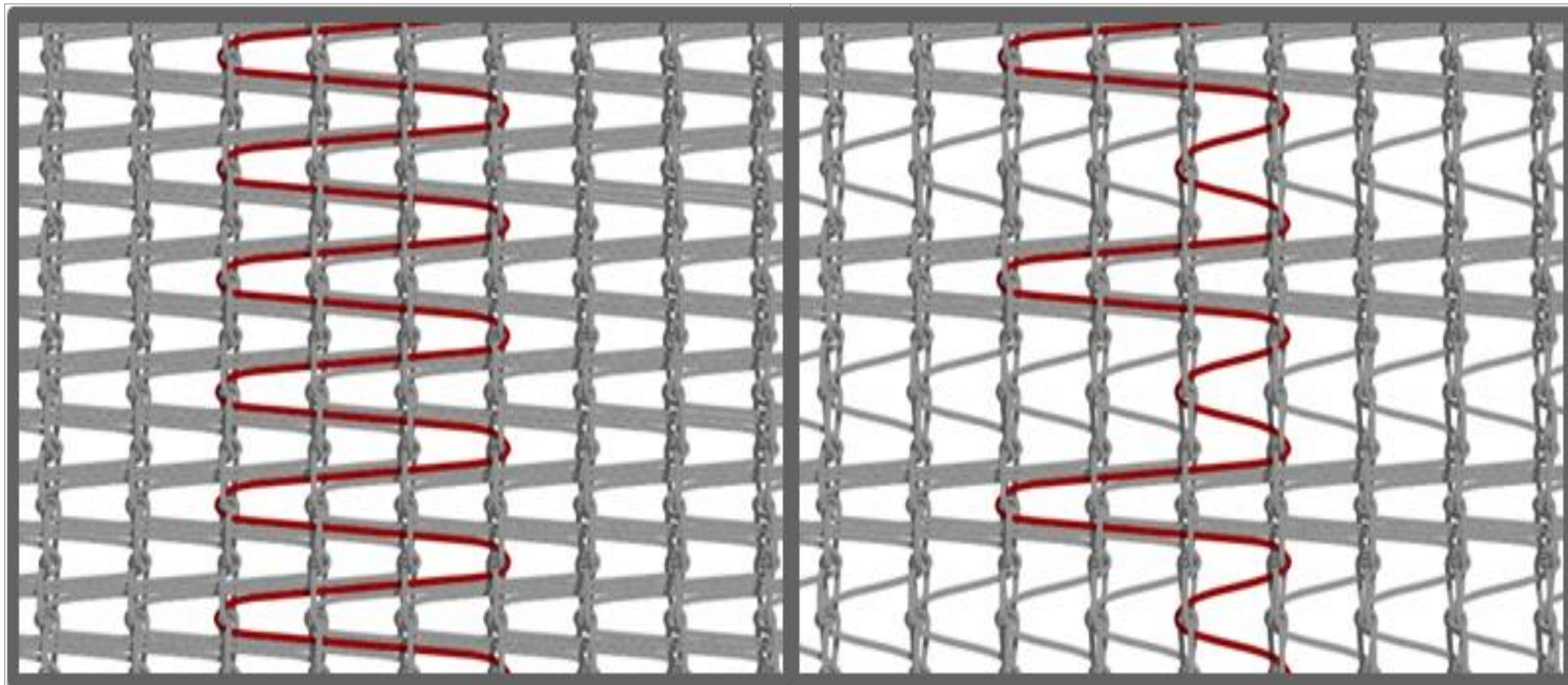
Lapping: 0-0 / 2-2 //
Repeat length 2



Lapping: 0-0 / 2-2 / 0-0 / 4-4 //
Repeat length 4



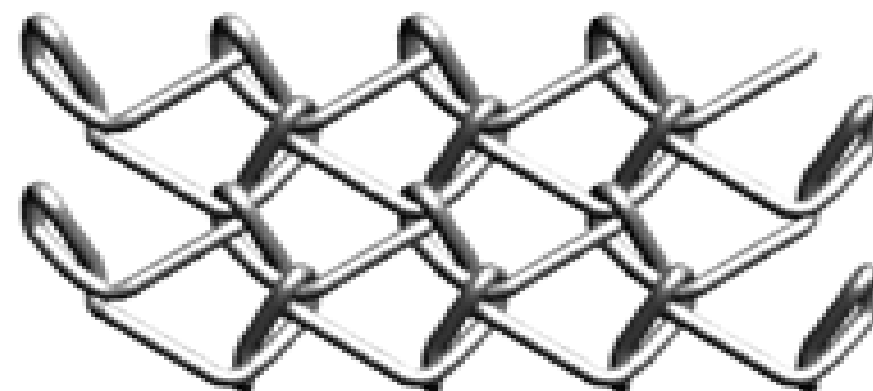
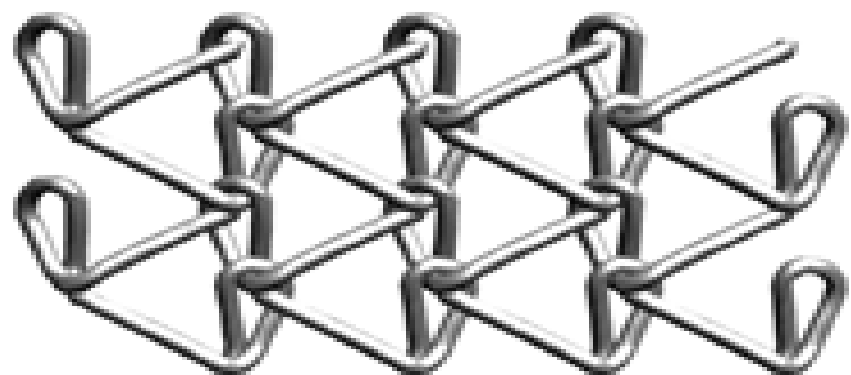
Inlay



Properties of the basic lappings

Basic lapping:

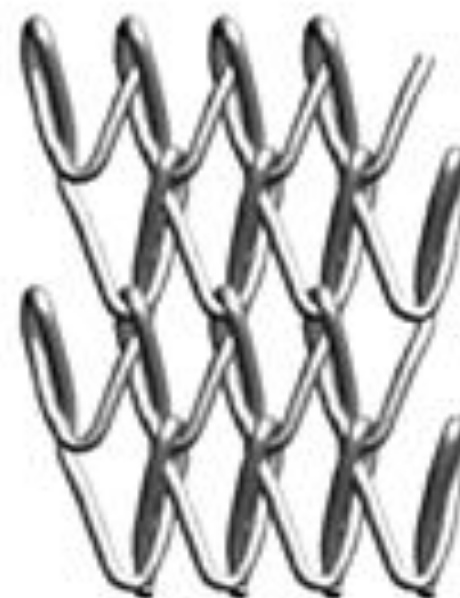
1 x 1



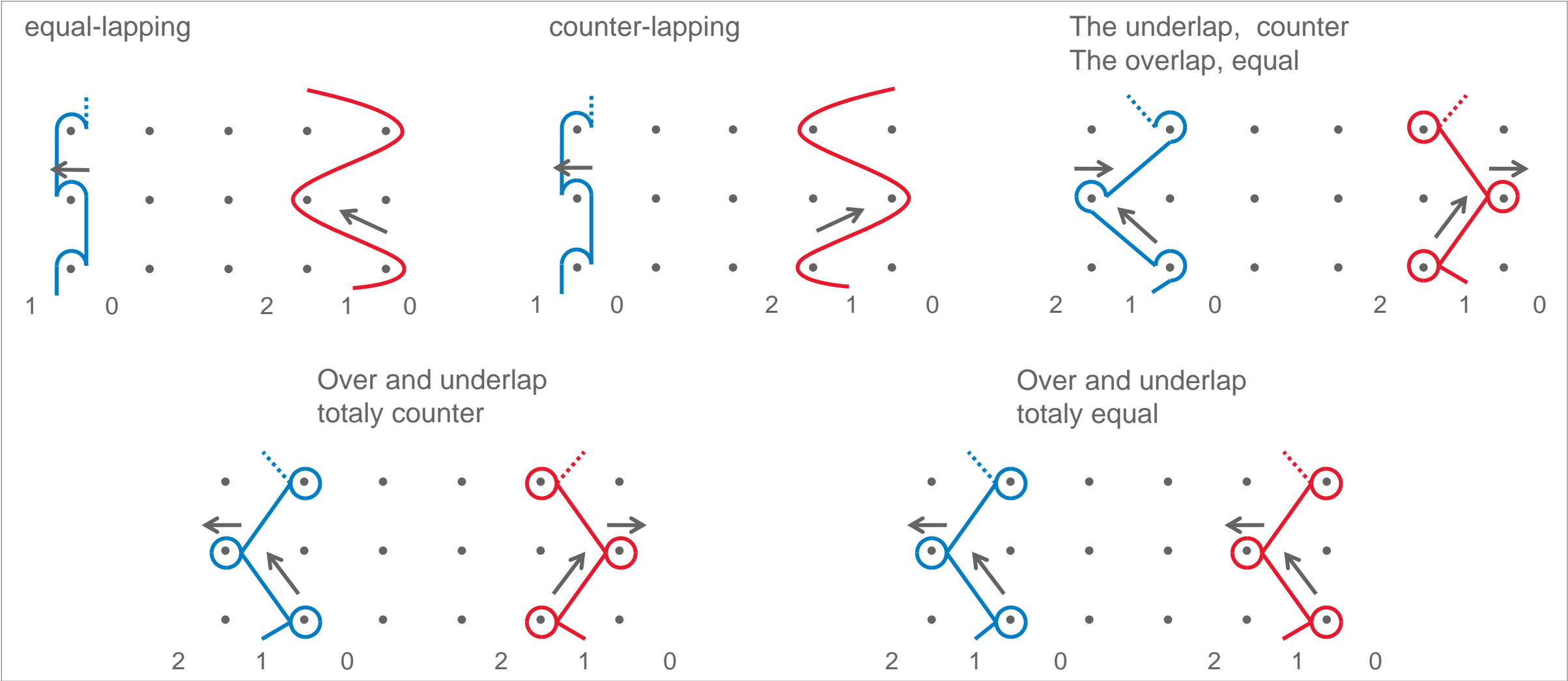
Properties of the basic lappings

Basic lapping:

1 x 1



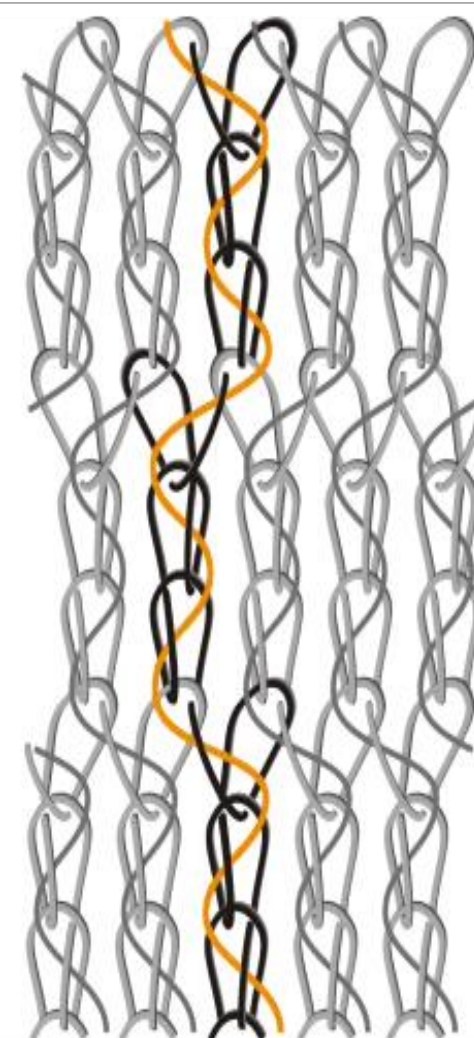
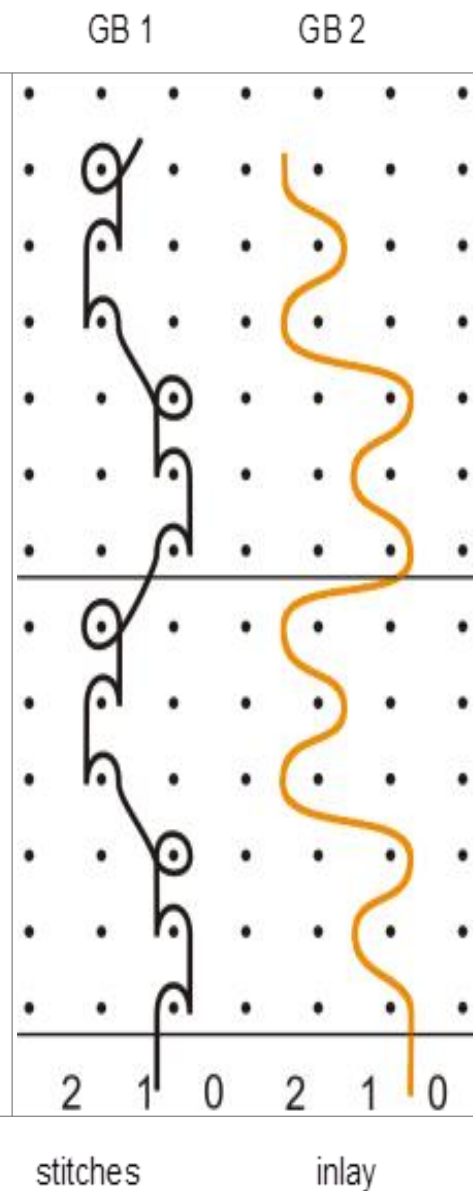
Equal- and counter-lapping



Honeycomb

GB 1: 1-0 / 0-1 / 1-0 / 1-2 / 2-1 / 1-2 //

GB 2: 0-0 / 1-1 / 0-0 / 2-2 / 1-1 / 2-2 //



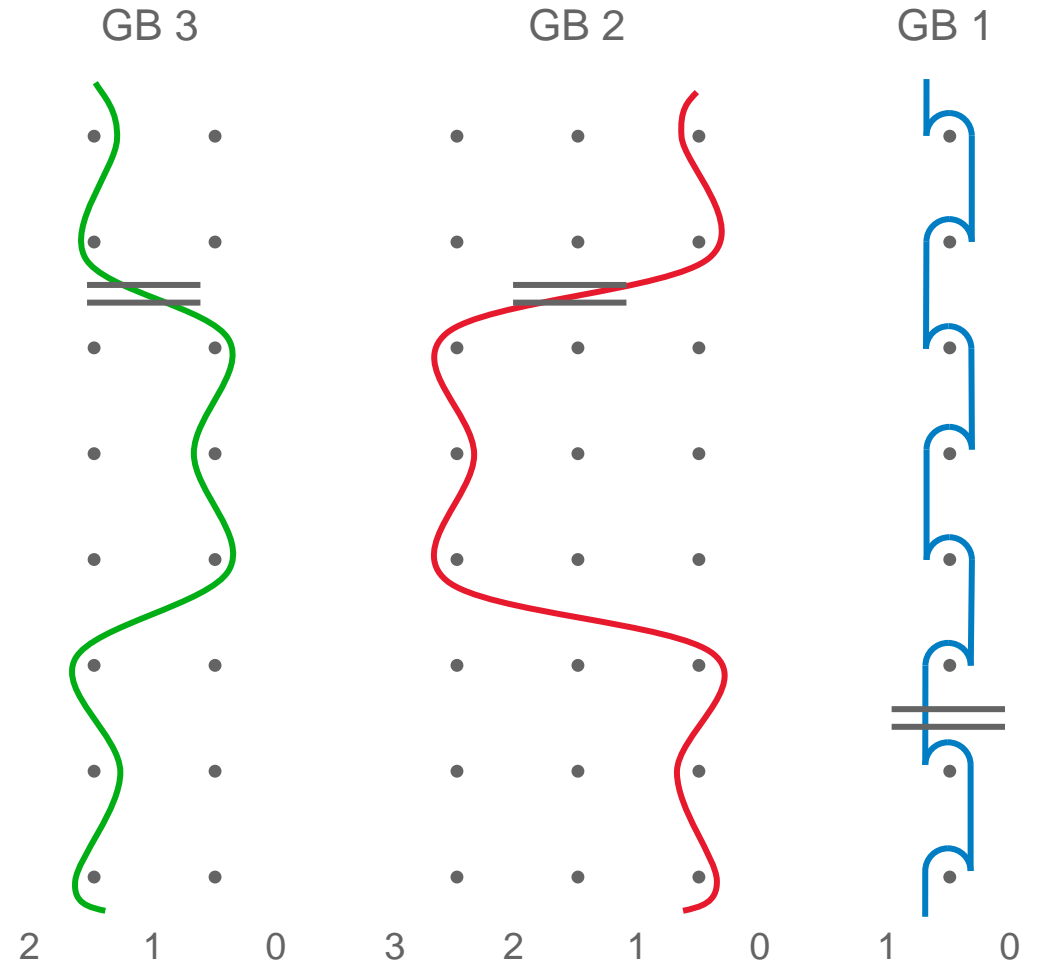
technical back of fabric

Marquissette or Squarenet

GB 1: 1-0 / 0-1 //

GB 2: 0-0 / 1-1 / 0-0 / 3-3 / 2-2 / 3-3 //

GB 3: 2-2 / 1-1 / 2-2 / 0-0 / 1-1 / 0-0 //



Properties of combined lapping

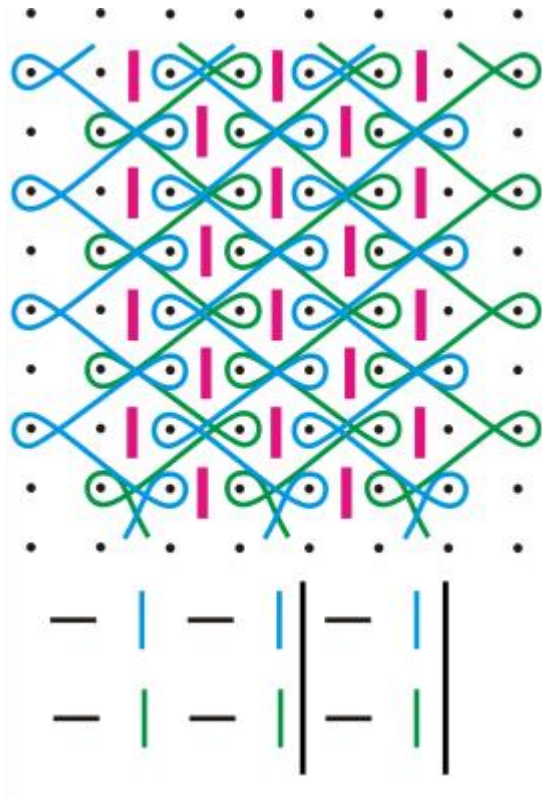


counter-lapped lapping



equal-lapped lapping

Mesh 2 x 1



GB 1: 1 - 0 / 2 - 3 //

Threading 1out/1in//

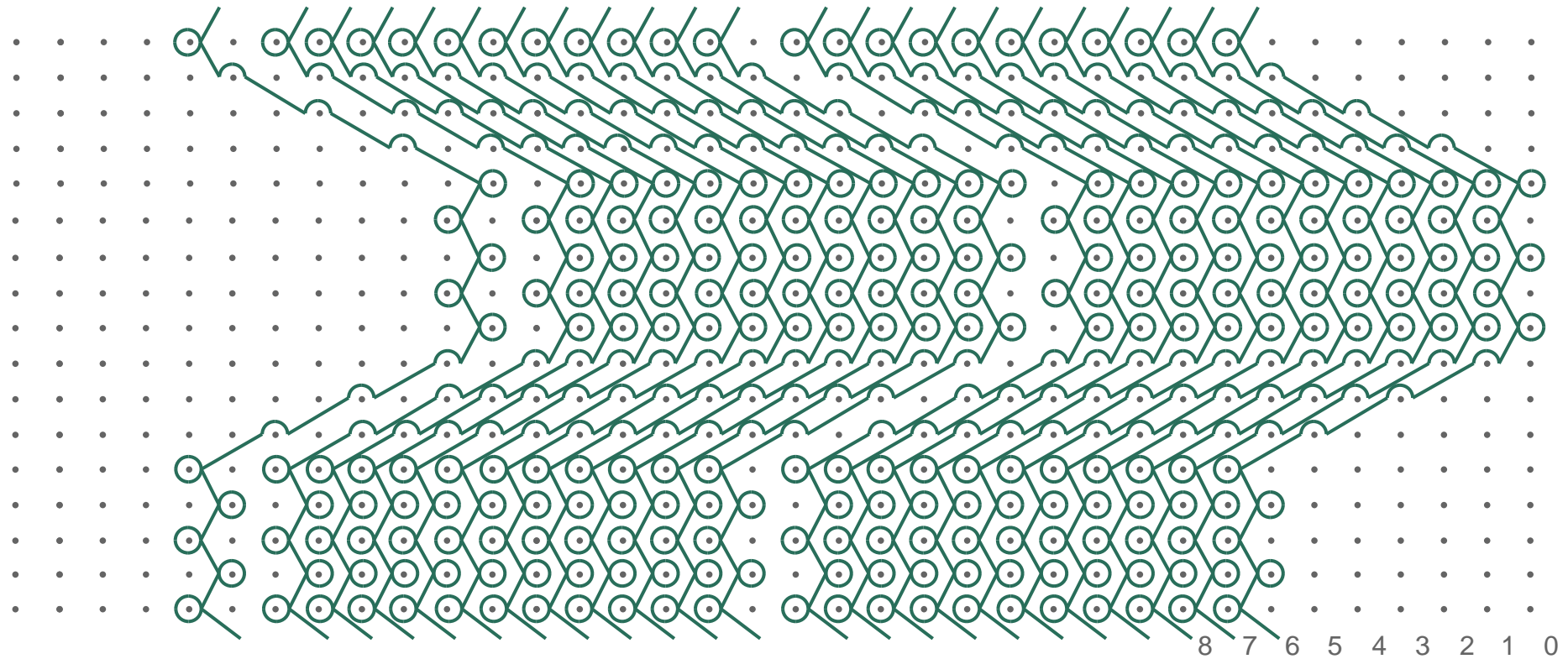
GB 1: 2 - 3 / 1 - 0 //

Threading 1in/1out//

Mesh – GB 2 – Threading 11 in 1 out

Lapping: 7-8 / 7-6 / 7-8 / 7-6 / 7-8 / 6-5 / 4-3 / 2-1 / 1-0 / 1-2 / 1-0 / 1-2 / 1-0 / 2-3 / 4-5 / 6-7 //

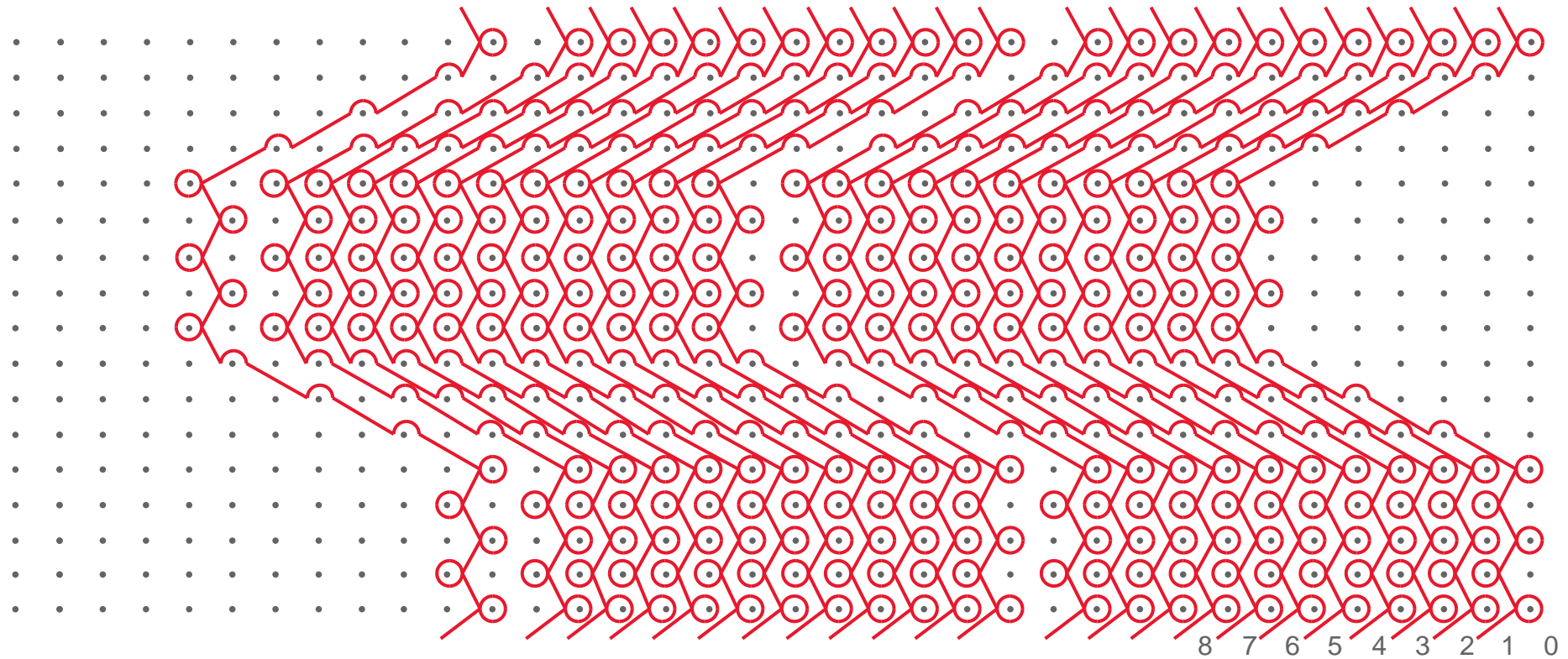
Repeat length : 16



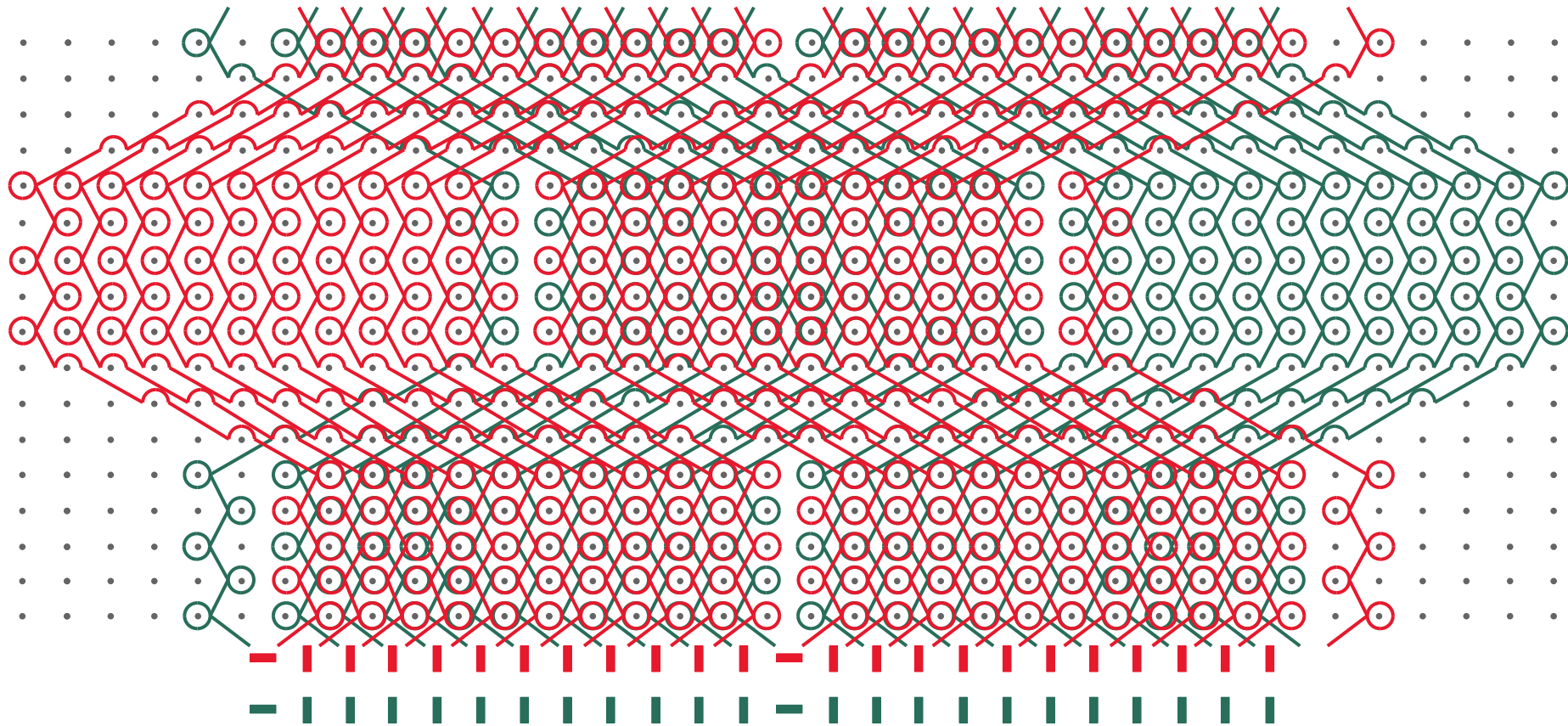
Mesh – GB 1 - Threading 11 in 1 out

Legung: 1-0 / 1-2 / 1-0 / 1-2 / 1-0 / 2-3 / 4-5 / 6-7 / 7-8 / 7-6 / 7-8 / 7-6 / 7-8 / 6-5 / 4-3 / 2-1 //

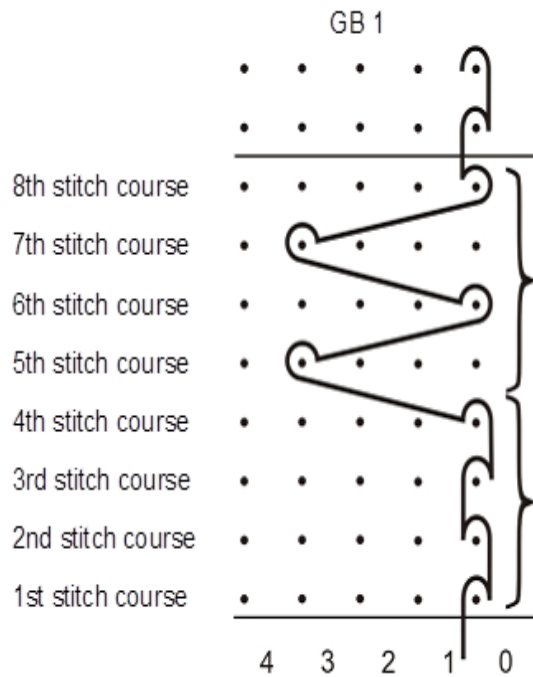
Repeat length : 16



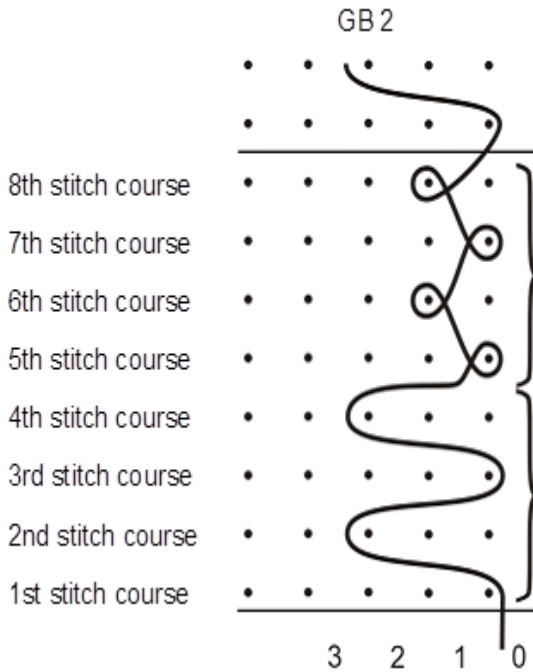
Mesh – GB 2 + GB 1



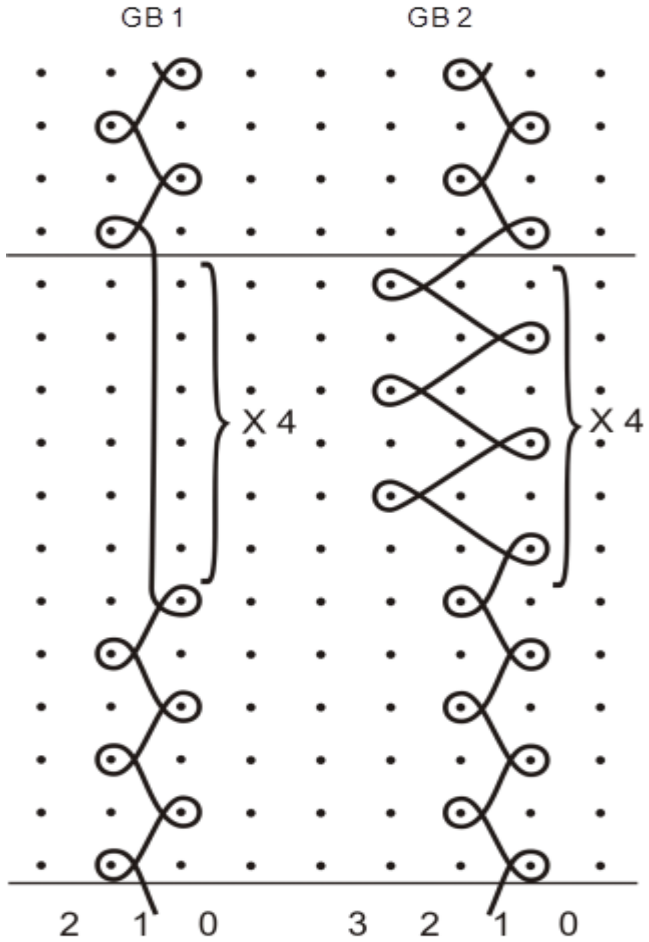
Multispeed



2nd sequence
1st sequence



2nd sequence
1st sequence



KARL MAYER Textilmaschinenfabrik GmbH

Postfach 1120 · 63166 Obertshausen · Brühlstraße 25 · 63179 Obertshausen · Germany
T +49(0)6104 402-0 · F +49(0)6104 402-600 · info@karlmayer.com · www.karlmayer.com

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