

The Production of kilim fabrics in mass production on shuttle-less looms, and giving them the appearance of handcraft.

Dr. Ahmed M. Salah

Lecturer at Applied Arts Faculty, Damietta University. Egypt

ahmed.salah442@hotmail.com

Dr. Abeer Ragheb El-Etriby

Lecturer at specific education, Damietta University. Egypt

abeereletreby@gmail.com

Abstract:

The demand for kilim products is becoming more and more needed in many markets. A new approach to reduce the production costs of the kilim based on the idea to produce kilim in mass production using the shuttle-less looms. The aim of this research is to find an innovative production methods with the helping of the textiles CAD/CAM systems and the superior facilities of the shuttle-less looms using a new weaving structures and an alternative effective fancy materials, to help the upholstery designers to build their own customers perspective products in order to reduce the cost of the traditional kilim products. This process starts with an open call on to a community of hobbyists and interested customers to hand in a new product concept. Feedbacks of the hobbyists and customers have produced as a kilim designs by the aid of the textiles CAD/CAM systems (computer aided design/ computer aided manufacturing) in order to be produced on the shuttle-less looms, and giving the produced kilim the appearance of the handcraft materials by making the kilim ending and intersections using the hand-made crochets. The experimental result indicates that kilims could be produced in mass production with shuttles looms. It is also found that the designs and motives of the woven kilims could be more detailed, However the cost of the produced woven kilims are 75% low in comparison to the handcraft kilims, however the maximum colours that could be woven together is six.

Key Words:

Upholstery fabrics, floor-covering fabrics, Kilim, Textile CAD/CAM, carpet ending and intersections, hand-made crochets, shuttle-less looms.

الملخص:

أصبح الطلب على أقمشة الكليم في تزايد مستمر في العديد من الأسواق. مدخل جديد خفض تكاليف إنتاج هذه النوعية من الأقمشة قائم على فكرة الإنتاج الكمي على الأنوال اللامكوكية. تهدف هذه الدراسة الى محاولة ابتكار تراكيب نسيجية واستخدام مجموعة من الخيوط والخامات الزخرفية متعددة التأثيرات لتلائم إنتاج هذه النوعية من الأقمشة (الكليم) وتسهيل من عمليات إنتاجها على الماكينات الامكوكية بمساعدة برامج التصميم والتصنيع بواسطة الحاسب الألى، من أجل مساعدة مصممي المنسوجات المنزلية في بناء المنتجات التي تلبي احتياجات مستهلكي هذه النوعية من الأقمشة من خلال خفض تكاليف إنتاجها ورفع القيمة الجمالية لها من خلال طباعتها بتقنية الطباعة الرقمية. وتبدأ هذه العمليات بمجموعة من الاتصالات المفتوحة مع المجتمع والهواة وكل المهتمين بهذه النوعية من المنتجات للمساعدة في وضع أساسيات تصميم هذه المنتجات، وتساعد التغذية الراجعة من هذه المعلومات في وضع المعايير الأساسية لتصميم هذه الأقمشة والتي يتم

ترجمتها من خلال برامج التصميم والتصنيع بمساعدة الحاسب الألى تمهيدا لإنتاجها على الانوال اللامكوكية، وإعطاء أقمشة الكليم المنتجة مظهرية أقمشة الكليم اليدوي من خلال مجموعة من تصميمات المشغولات اليدوية للكروشييه في عمل نهايات وفرنشات اقمشة الكليم المنتجة. وقد توصل البحث الى انه يمكن انتاج نوعيات جديدة من الاقمشة تحاكي أقمشة الكليم اليدوي على الانوال اللامكوكية بتكاليف منخفضة عن مثيلاتها التقليدية بنحو 75%، وكذلك فان الوحدات والتصميمات وأعمال الكروشييه اليدوية لاقمشة الكليم المنتجة من الممكن أن تكون أكثر دقة وتفصيلا عن مثيلاتها فالكليم اليدوي، فى حين أن الحد الاقصى لالوان الحمات التي يمكن استخدامها معا هو ستة اللوان فقط.

الكلمات المفتاحية:

أقمشة المفروشات, أقمشة أغطية الارضيات, برامج التصميم بمساعدة الحاسب الالى, الكروشية اليدوي, الانوال الامكوكية.

1. Introduction

There has been increased interest in so-called flat woven carpets in recent years. These carpets do not have a pile in the strict sense of the word but utilise relatively thick warp yarns which ‘float’ on the fabric surface. (WHITEFOOT D.,2009 P:132). Kilim is the best-known type of flat woven carpet, made by interweaving the variously coloured wefts and warps. Though produced for daily use, they are loaded with profound aesthetic values, colours and motifs used on kilims display a type of symbolism which serve to differentiate various social groups from others. (Unal S.,2009 P:5). However, Kilim is a product of daily use in floor covering and decoration with continuous and increasing demand, and the history of making kilim is an integral part of the “cultural and social” history of Egypt. Producing kilim fabrics in mass-production and giving them the appearance of the traditional hand-craft kilim by making crochet fringes are supporting both of math-production of the egyption textiles industries and the Micro, Small & Medium

Enterprises (MSMEs) of the hand-crafts and provide job opportunities for young people who are engaged in such crafts to make contemporary designs of the Egyptian kilim fabrics’, considering the economic, environmental and social dimensions, preserve the Egyptian craft identity and protect handicraft industries from disappearing. However, The Marketing is evolving to focus on getting the right goods and services to the right people, at the right place and time, with the right price, through the use of the right blend of promotional techniques. (Joseph F., et. al., 2003 P:5). Producing kilim in mass-production reduce the product cost in order to add-value to consumers. Crocheting: is a handicraft made by the construction of a patterned fabric by hand using the crochet hook or needle and a single strand of yarn to form interlocked loops. Dorinda M.,(2016 P:2). Crochet can be practiced by almost anyone and has a diversity of meanings, of objectives, and purposes. It can be a hobby, an art, a leisure activity, a business, a social critique, or all of these at once. Its prominence in the lives of women, along with other textile and fiber crafts, makes its elaboration and theorization as important as the study of any text or work of “fine-art”. (S. Hailey,2015). Crochet, which is defined by Merriam-Webster’s Dictionary as “needlework consisting of the interlocking of looped stitches formed with a single thread and a hooked needle,” is typically started by creating a series of loops, or chain stitches, by pulling a hook through the

preceding loop after wrapping the yarn around the hook. (C. Gillette, 2002, p. 22). Today crochet remains an important needle art as it swings in and out of fashion prominence. One of the reasons it continues to be popular is because it requires little equipment and time. With different kinds and textures of yarn available, you can create many beautiful and useful crocheted items for your wardrobe and your home. (M. Baker, 2005). Crochet and macramé are techniques employed in the production of both aesthetic and functional products. They are sometimes combined with different materials such as beads, feathers and fabrics. However, the combination of both techniques in artefacts production for variety is missing. Dorinda M.,(2016 P:2).

2. Problem Statment

Producing traditional kilim on hand looms is very expensive and cannot cover all the market share from the floor covering fabrics. Intentions to produce this kind of fabrics in mass production are complicated because the materials were used in hand-woven kilim are very thick and heavy and may be not appropriate to be produced on the shuttle-less looms, so that, the main question of this research is: Is there any new approach could be appropriate to produce kilim fabrics in mass production, and giving them the appearance of the traditional hand made kilim?

3. Aims And Objectives

The aim of this research is to build an innovative production method with the helping of the textiles CAD/CAM systems and the superior facilities of the shuttle-less looms, to help the upholstery designers to build their own customers perspective products in order to reduce the cost of the traditional kilim in mass production.

4. Hypothesis and Methodologies

- 1- Textiles CAD/CAM software and shuttle-less looms, and making the use of the new materials and the inovative weaving structures could help in producing kilim in mass production.
- 2- The kilim fringes using the hand-made crochets could help in giving the produced kilim the appearance of the traditional kilim.

This research is going to describe a methodology for a new approach, which could significantly reduce the production cost of the traditional handwoven kilim fabrics by using the shuttle-less looms.

4.1 Creating kilim designs:

All fabrics were designed on Nedgraphics CAD/CAM software according to the following steps:

4.1.1. Putting the design ideas for kilim fabrics:

This step has to be done by the aid of the one of the most famous Textile CAD/CAM software (Nedgraphics - Texcell).

The most common workflow usually follows these sequenced steps:

1. Digitization of croquis.
2. Color reduction and cleaning.
3. Finishing design in step and repeat.
4. Assigning technical production information.

4.1.2. Graphic design preparation (Texcell):**A- Design input:**

To open a file containing an existing image which will be used to create the repeat for a new design. Alternatively, Could be executive by clicking on the corresponding toolbar button, or using the keyboard shortcut CTRL+O. Upon using the Open command, a typical dialog window will open, as follows:

B- Design cropping:

Reducing the design to just a selected area, and working with it as a new design, Is the next step to be done after inputting the design, And this could be applied by selecting the area of the design to be cropped followed by using the crop order from the transform menu.

C- Design resizing:

Resizing the design is very important process, which could be applied to give the design the amended properties in order to be suitable for weaving, whereas the function of this process is to define the following properties:

Pixel X= number of warp ends/Repeat

Pixel Y= number of weft yarns/Repeat

Size X= Repeat width/ (Cm, mm, inch or pixels)

Size Y= Repeat High/ (Cm, mm, inch or pixels)

Resolution X= number of warp ends/Cm

Resolution Y= number of weft yarns/Cm

D- Design Color reduction:

The inputted designs are usually true color images which have (more than 16 million colors), this huge number of colours should be reduced to the exact number of fabric actual number of colors in-order to be suitable to the predefined number of the weaving structures that will be used in the fabric, and this could be proceeded as follow:

Electronic color reduction:

Choosing the convert to design file (photo) order, will convert the design from true color image to bitmap image with maximum 256 colors, however, choosing the number of colors is an option to define the exact number of the design colors.

E- Design redrawing:

After the electronic color reduction process, the design will still has many colors and curves distortions, which have to be reduced manually.

By finishing the redrawing process, the design will be ready to be exported to the product creator in order to produce the complete card of the design.

4.1.3. Weaving structures preparation (Weave editor):

This process is about to create the amended weaving structures, which will be used to create the specific needed fabrics.

4.1.4. Jacquard harness Preparation (Loom Editor):

The machine or the harness layout is important part, which has to be created before to proceed to the final step (product creator), whereas, describing the map of the jacquard hooks and its capacity are important information to create the amended fabric.

4.1.5. Executive Design preparation (product creator):

By reaching this stage, all the data and information had to be prepared and saved in the program archive, as:

Design, weaving structures and harness system, whereas starting to produce the executive design has to be applicable according to the following procedures:

Design properties:

By selecting the new order from the file menu, the properties dialog box will be opened automatically, and asking to input the information which, is needed to produce the amended fabric.

Card production:

Once selecting the weaves structures are finished, the fabric electronic card is ready to be produced, and this could be done simply by refreshing the card view.

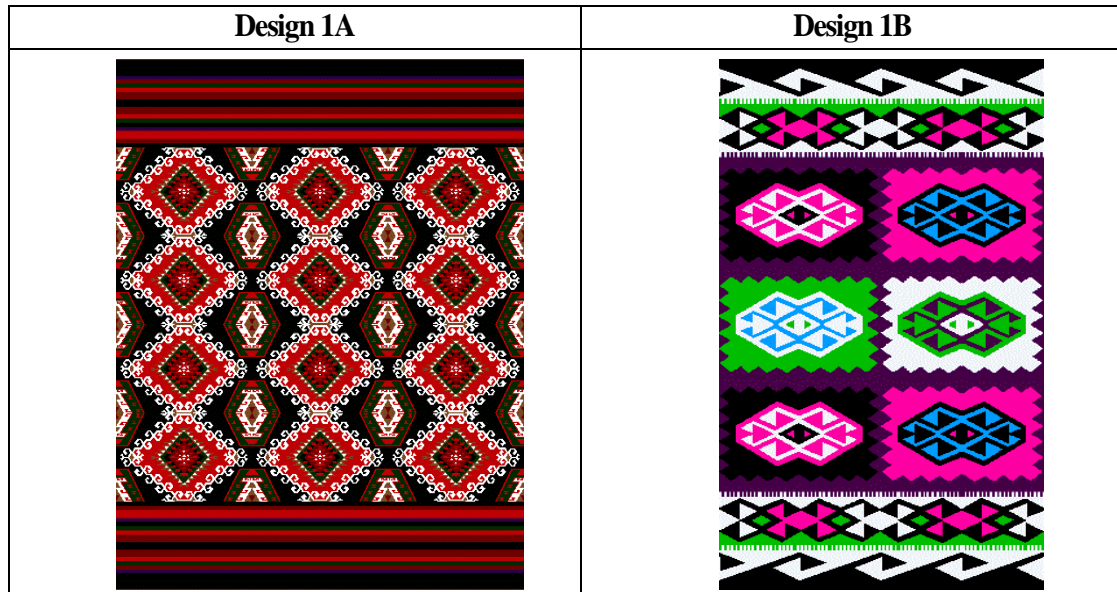
4.2.1. Materials**The produced kilim fabrics are using the following specifications:**

Yarn of count 150 Denier, 84 EPI was used as warp and Yarns of four different counts such as (2000 dn, 2250 dn, 14/6 Nm) were used as Wefts. 3 different weft sequences such as (1 F, 4 B), (2 F, 6 W, 2 B), and (1 F, 3 W, 1 B), and (1F:2W:1B) three types of weft yarns were used (Polypropylene, chenille PE, chenille PE(micro fiber) and Poly Acrylic), All fabrics were produced in Double weave wadded structure with 50, and 60 PPI. Table (4.2.1.1) shows the fabric specifications of sample A:

4.2.1.1: Sample(A) Fabric specifications:**Table 4.2.1.1: Fabric specifications**

Sample	Weft Sequence	Weave	Denisties		Count (Td)		Materials		Fabric Finished Wight (gm/m ²)
			EPI	PPI	Warp	Weft	Warp	Weft	
A	(1F:2w:1B)	Double weave	84	60	150/1	2250	PE	Ch	640

Table 4.2.1.2: Design



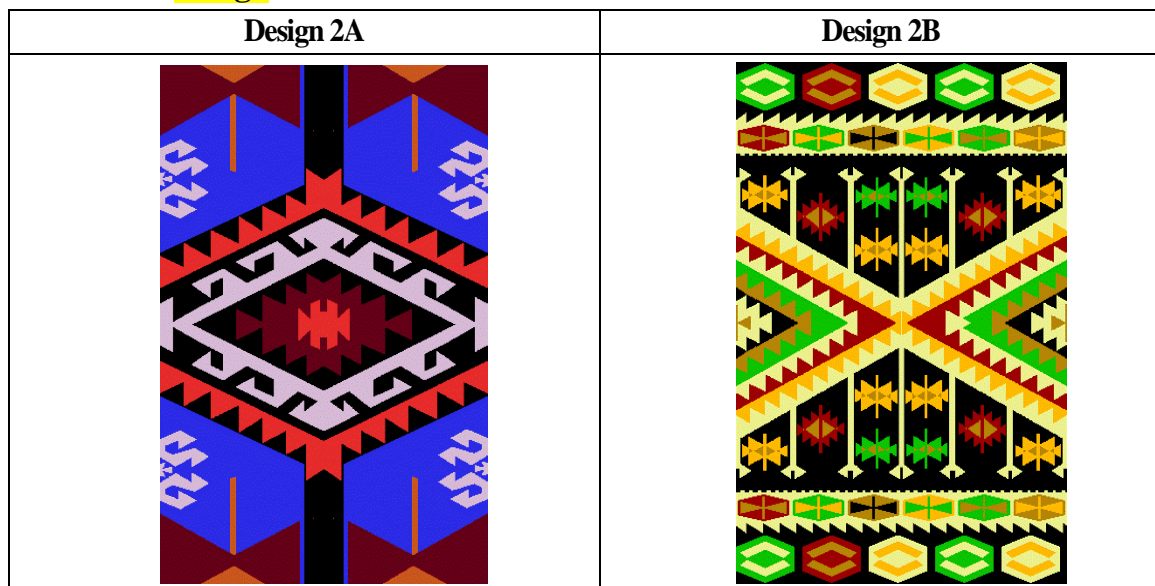
4.2.1.3: Sample(B) Fabric specifications:

Table (4.1.1.3) shows the fabric specifications of sample B:

Table 4.2.1.3: Fabric specifications

Sample	Weft Sequence	Weave	Denisties		Count (Td)		Materials		Fabric Finished Wight (gm/m ²)
			EPI	PPI	Warp	Weft	Warp	Weft	
B	(1F:2W:1B)	Double weave	84	60	150/1	2000,2250	PE	3Ch,PP	620

Table 4.2.1.4: Design



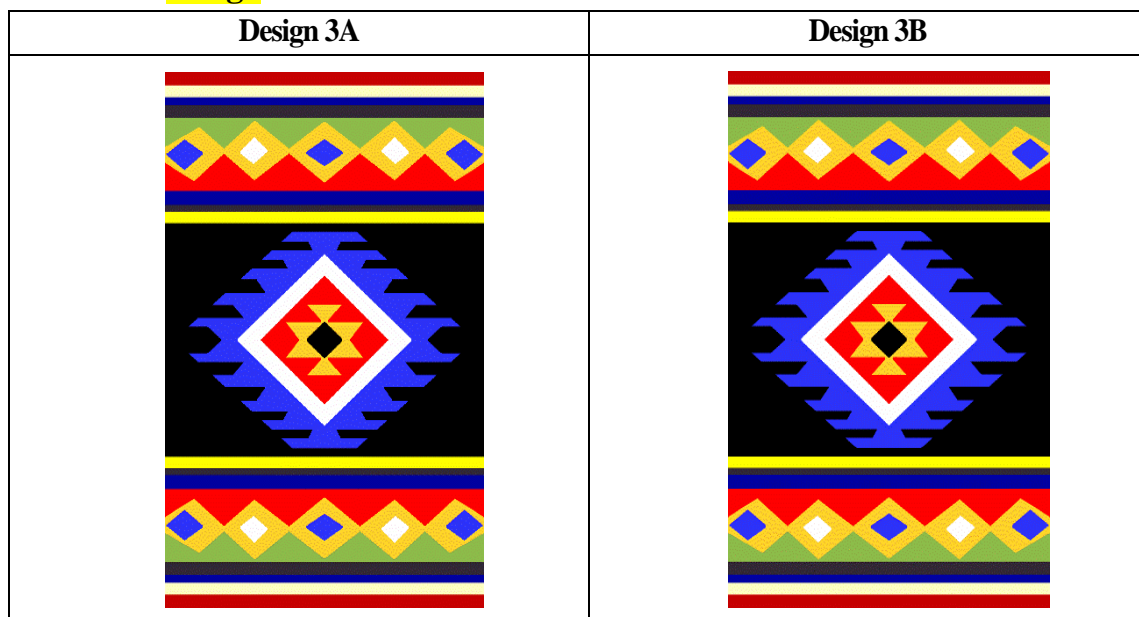
4.2.1.5: Sample(C) Fabric specifications:

Table (4.1.1.3) shows the fabric specifications of sample C:

Table 4.2.1.5: Fabric specifications

Sample	Weft Sequence	Weave	Denisties		Count (Td)		Materials		Fabric Finished Wight (gm/m ²)
			EPI	PPI	Warp	Weft	Warp	Weft	
C	(1F:3W:1B)	Double weave	84	50	150/1	14/6 Nm	PE	Acrylic	700

Table 4.2.1.6: Design



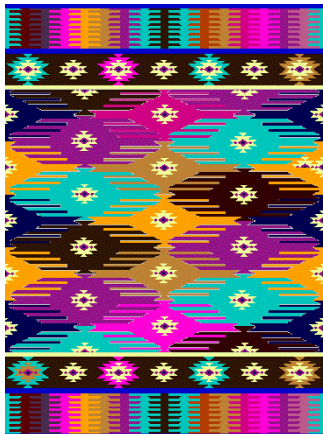
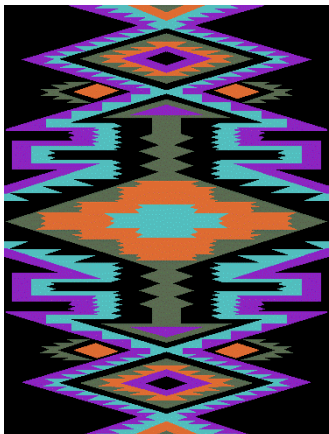
4.2.1.7: Sample(D) Fabric specifications:

Table (4.2.1.7) shows the fabric specifications of sample D:

Table 4.2.1.7: Fabric specifications

Sample	Weft Sequence	Weave	Denisties		Count (Td)		Materials		Fabric Finished Wight (gm/m ²)
			EPI	PPI	Warp	Weft	Warp	Weft	
D	(1F:3W:1B)	Double weave	168	50	150/1	2250	PE	Ch	550

Table 4.2.1.8: Design

Design 4A	Design 4B
	

4.3 Applying crochet techniques to the produced kilim fabrics:

This research is based on providing the kilim fabric with appearance of hand made kilim by cleaning the edges and making the distinctive warp ends of the kilim by following the next procedures:

1. Description of the basic crochet stitches.

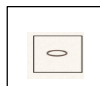
2. Detailed presentation of the used crochet techniques.

4.3.1 Description of the basic types of crochet stitches:

The produced samples of this study includes four (4) samples using the art of crochet.

- The basic types of basic the crochet stitches:

- Chain stitch (SLIPKNOT):



The most basic stitch used to begin a piece

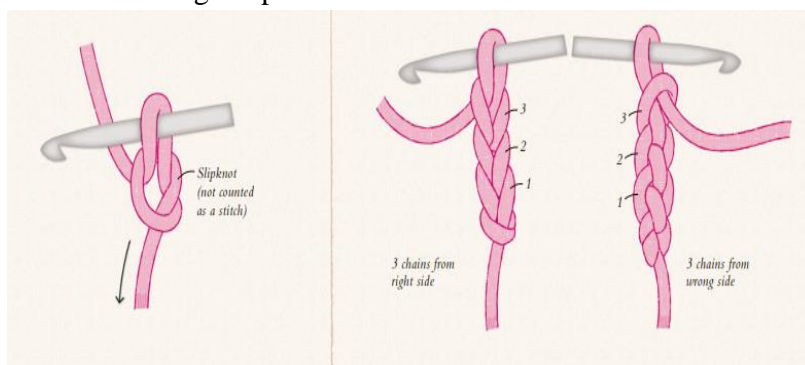


Fig. (1) Chain stitch (SLIPKNOT)

- single crochet:



Begin with a foundation chain; do not count the slipknot.

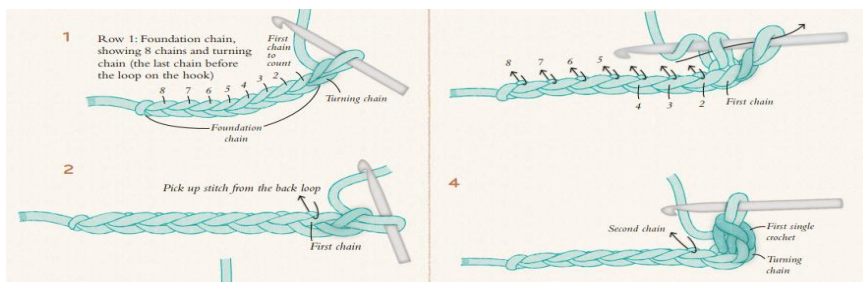


Fig. (2) Single crochet

• **Half double crochet:**



The first 2 chains of the foundation row are the turning chain for the first row and are counted as the first stitch. Wrap the yarn once around the hook, insert the hook in the foundation chain and pull up a loop (3 loops are on the hook), yarn over, and pull up a loop through all 3 loops.

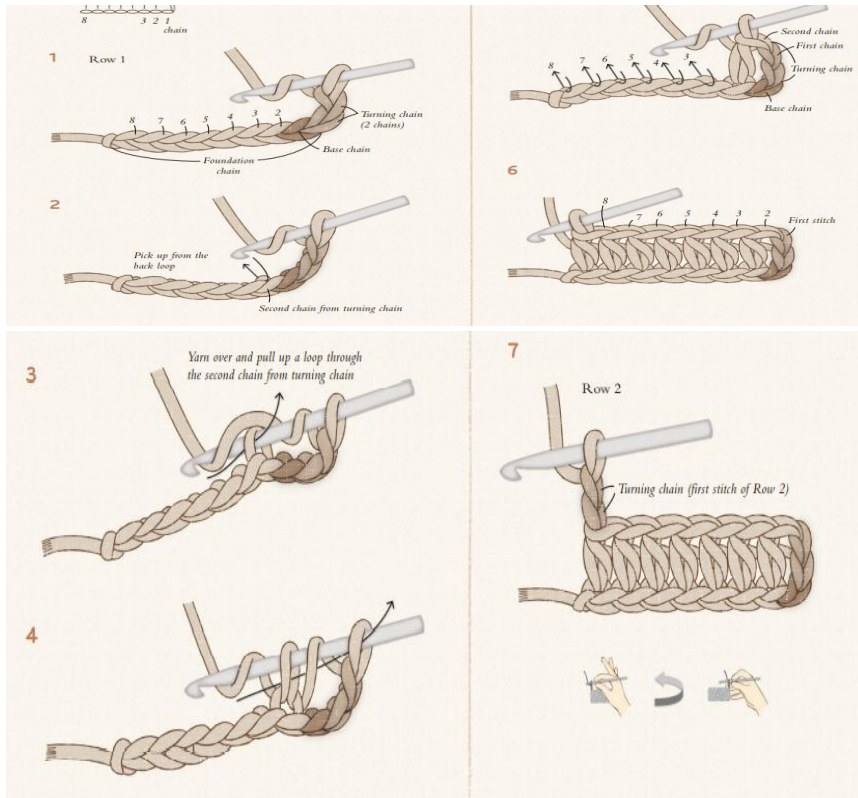


Fig. (3) Half double crochet

• **Double Crochet:**



The first 3 chains are the turning chain for Row 1 and are counted as the first stitch. Yarn over once, insert the hook in the foundation chain and pull up a loop (3 loops are on the hook), yarn over, and pull the yarn through 2 loops twice.

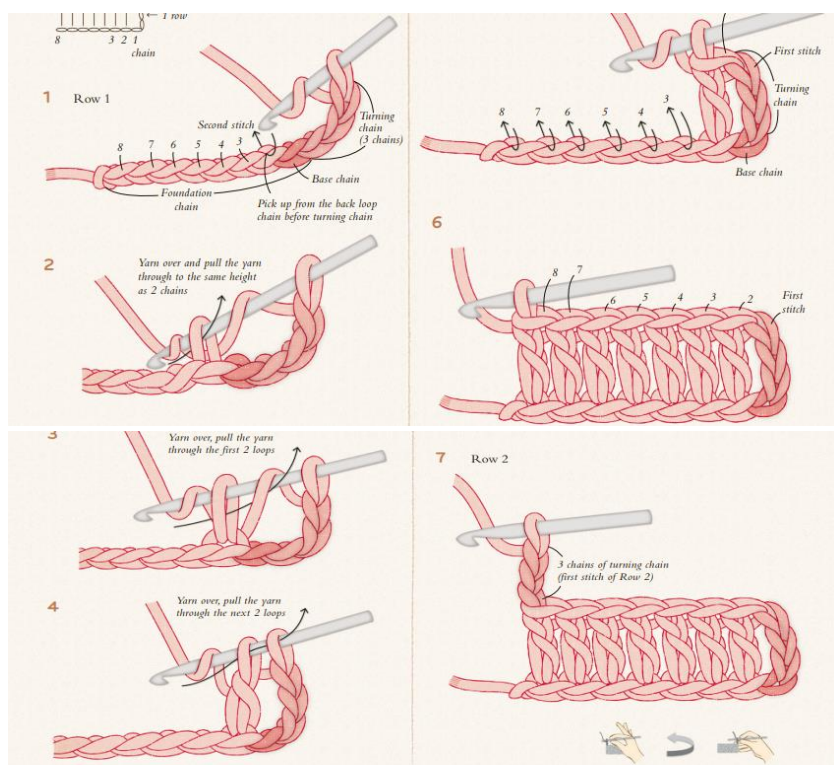


Fig. (4) Double crochet

4.3.2 Detailed presentation of the used crochet techniques.

This research is going to apply two different techniques in order to make an aesthetic hand-made finishing to the mechanical produced kilims, as follows:

1- Finishing the outer ends (edges) of the manufactured kilim fabric towards the weft:

The first way, The swelling. It is a technique used in clothing and was used in the same manner to clean the edges and make them straight. Among its disadvantages is the difficulty in ending the kilim edges because of the thickness of both the swelling and the kilim and the difficulty of passing a crochet hook through them. There is a difference in the height of the sides of the kilim from the middle area. Different sizes of the kilim due to a decrease of at least 1 cm. from the sides

of the carpet and bending it. Finishing the four sides of the kilim by using the crochet stitches (single crochet stitch, half double crochet stitch) leaving spaces as much as on chain or two chains between stitches and that is, after trimming the edges with the regular pile. However, the second method is to apply only the overlock machine for making (over site stitch) on the edges. It is one of the appropriate options as it finished the edges without affecting the dimensions of the kilim and it is easy to pass a crochet hook through the carpet.

2- Finishing the outer bends (edges) of the manufactured kilim fabric towards the warp:

This step starts with making an installation row with crochet then continue with crochet by making installation row using a single crochet stitch or a half double crochet stitch as a foundation row to build the edge of the Kilim with crochet and that row could be stitch close to each other or separated with a chain or two and that depends on the final look desired for the edge then we continue with another row or two depending on the desired height for the produced kilim or making an installation row with crochet then continue with crochet and add fringes at the same time by repeating method (2) with adding fringes to the final row and that is a new form of crochet

stitches and merging fringes with it then holding both of them together by tie or warp the thread. This method is characterized by the fact that despite the presence of fringes, it can be easily disassembled, such as regular crochet stitches, and this is what distinguishes crochet fabric.

4.2.2.1: Crochet specifications:

Table (4.2.2.1) shows all crochet specifications were used in this research:


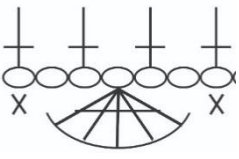
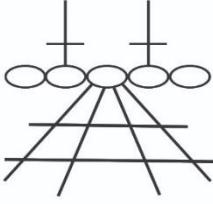
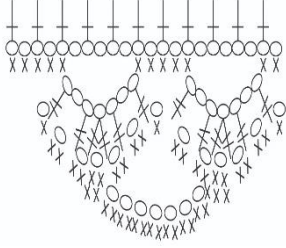




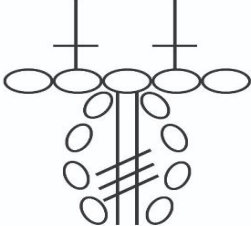
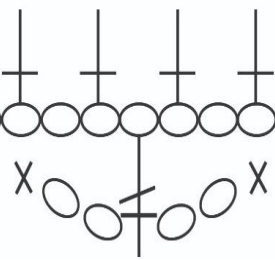
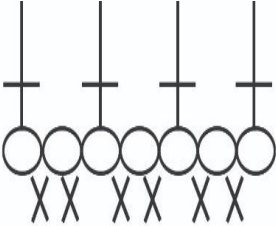
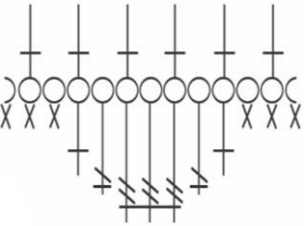




Table 4.2.2.1: Crochet specifications

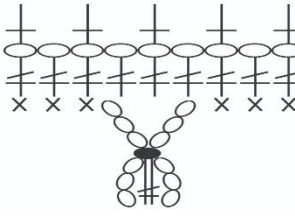
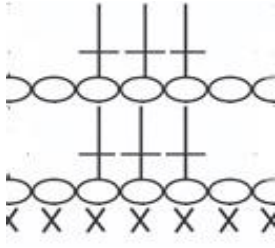
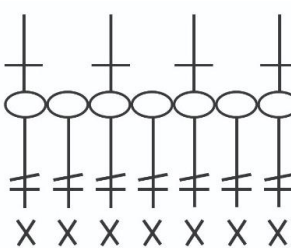
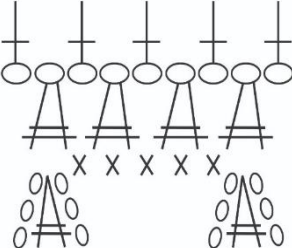



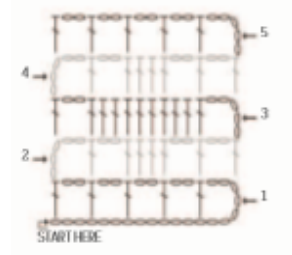
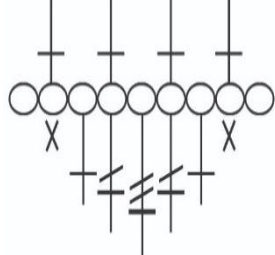
Item no.	Crochet Type	Yarn		cost		Total cost/ LE
		Type	Needle	Qty/gm	Time/min	
1	Scallop edging	cotton	Size 3	670 m for The first around all carpet, 54m for scallop stitch	325 107	Cost of time according to labor cost+ cost of material quantity according to material prices.
2	Scallop edging with fringes	Cotton6/4	Size 3	167	167	
3	Shell edging	Cotton6/4	Size 3	320 m for two edges	320	
4	Decorative shell stitch with fringe	Cotton6/4	Size 3	780 m for two edges	542	
5	Popcorn stitch with fringes	Cotton6/4	Size 4	233 m for two	333.5	
6	Petal endging with fringes	Cotton6/4	Size 3	76 m	164	
7	Single stitch with fringes and Contour	Cotton6/4	Size 3	87 m 98m	108 196	
8	Twisted Yarn fringes	Cotton6/4	Size 3	488m	610	
9	Row1:Filet stitch Row2:Single stitch with fringes	Cotton6/4	Size 3	413 m	248	
10	Row1: Double crochet Row2:	Cotton6/4	Size 4	125	166	

	Chains with popcorn Endging.					
11	Row 1:Double crochet stitche Row 2: single crochet with fringes	Cotton6/4	Size 3	99m	216	
12	Row1: double crochet stitch Row2:single stitch and Decorative fringes by double crochet	Cotton6/4	Size 3	108 m	270	
13	Row 1:Filet blocks crochet Row2: single stitch with fringes	Cotton6/4	Size 3	346 m	867	
14	Triangle decorative stitch with fringes	Cotton6/4	Size 3	130 m	216	
15	Decorative ending by (single, double,trible crochet stitches with fringes	Cotton6/4	Size 3	200 m	500	

Table 4.2.2.2: Crochet Patternss

Item No. 1	Item No. 2	Item No. 3	Item No. 4
			

			
<p>Item No. 5</p>	<p>Item No. 6</p>	<p>Item No. 7</p>	<p>Item No. 8</p>
			
			
<p>Item No. 9</p>	<p>Item No. 10</p>	<p>Item No.11</p>	<p>Item No. 12</p>
			

			
<p>Item No. 13</p>	<p>Item No. 14</p>	<p>Item No.15</p>	
			
			

4.2.2 Producing fabrics:

All fabrics were produced on Somet (Alpha) Loom equipped with Staubli (Dx100) jacquard with 2688 hooks, however, Table 4.1.2 demonstrates all the Machine specifications that were used in the implementation of the produced kilim fabrics as follow:

Table 4.1.2: Machine specifications

Machine Specifications							
Loom				Jacquard			
Company	Model	Date	Width	Company	Model	Date	Capacity
Somet	Alpha	2008	3400 mm	Staubli	DX100	2008	2688 hook

5. RESULTS AND Conclousions:

Groups of thick wefts could be used together on shutel-less looms incase of using the right weaving structures. In this research deffirent kinds of thick wefts suitable for using in flat-woven carpets were used

successfully, however the produced fabrics could be emulate the hand-woven kilim, specially after adding the hand-made crochet fringes to finish it. Produing of kilim fabrics on the shuttel-less loom has mor profit than hand-made kilim and motives produced in highly details.It is also noticed that rough thick wefts like local wools are hard to be weaved and affect directly the effeciency of the loom.Also the results indcated that the maximum number of weft colours could be produced together is six,however hand-made kilim could be produced with more colours and materials.Table no. (5.1),(5.2) shows some of the produced kilim fabrics and the most suitable hand-made crocet fringes, also the 3D presentations for the end use of these products.

5.1. Produced Kilim Fabrics:

Table 5.1 demonstrates apart of the produced kilim fabrics with the hand-craft crochet fringes, and how far they could be emulate the traditional hand-made kilims.

Table 5.1 Produced Kilim Fabrics

Item No. 1a	Item No. 1B
	
	
Item No. 2A	Item No. 2B

	
	
<p>Item No. 3A</p>	<p>Item No. 3B</p>
	
	
<p>Item No. 4A</p>	<p>Item No. 4B</p>

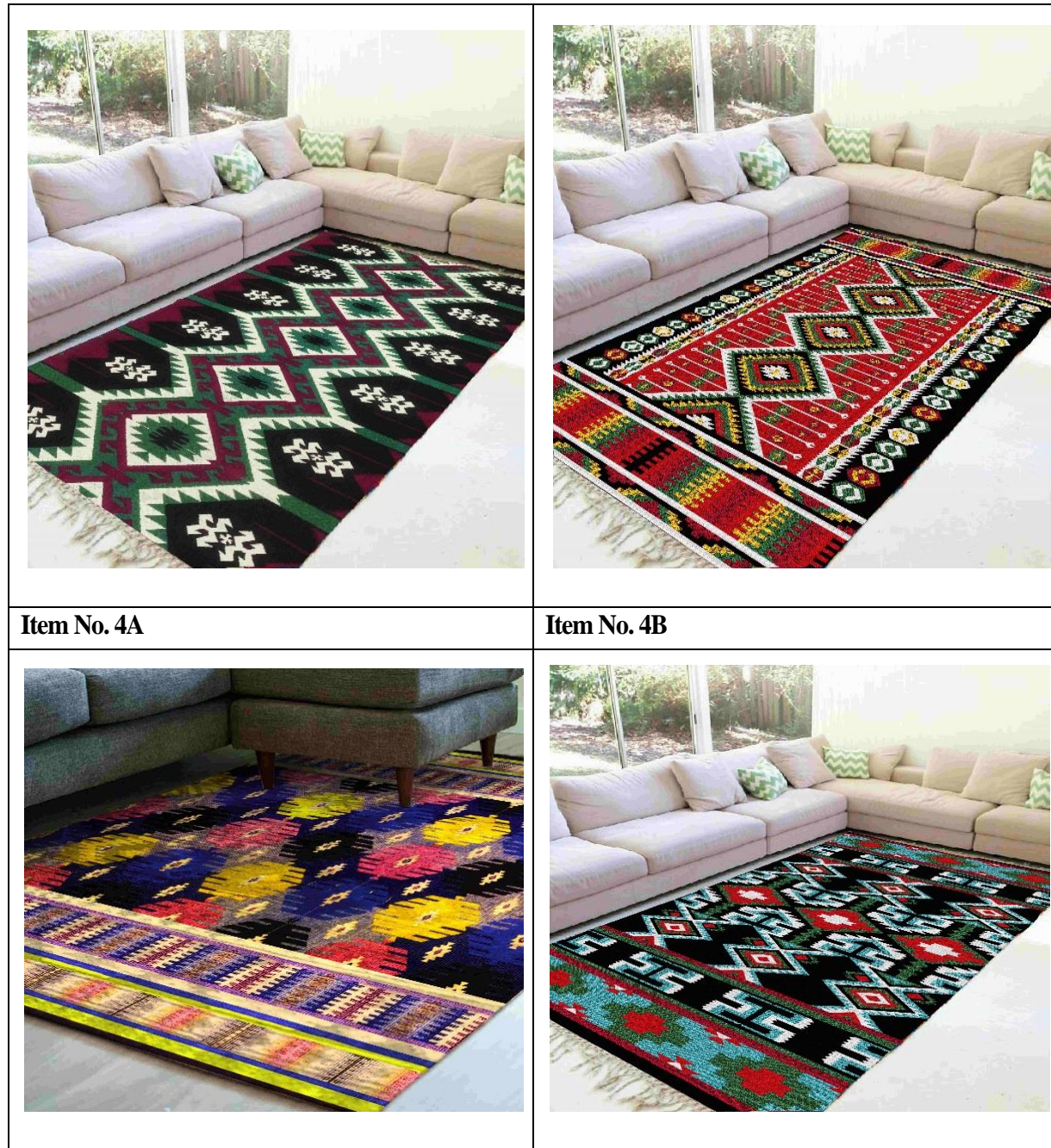


5.2. Produced Kilim Fabrics in 3D presentation:

Table 5.2 demonstrates apart of the produced kilim fabrics in 3D, to show how far they could be emulate the traditional hand-made kilims.

Table 5.2 3D Presentation of Produced Kilim Fabrics

<p>Item No. 1a</p>	<p>Item No. 1B</p>
	
<p>Item No. 2A</p>	<p>Item No. 2B</p>



6. CONCLUSIONS:

The experimental result indicates that kilim fabrics could be produced in mass production with shuttles looms. It is also found that the designs and motives of the woven kilims could be more detailed, However the cost of the produced woven kilims are 75% low in comparison to the handcraft kilims. Also the kilim fabrics could be produced with four different specifications with four different materials, and four different weft sequences, also two different warp denisties could be applied to the produced fabrics.while the handwoven frange crochets gives the produced kilim fabrics the traditional handwoven kilim appearance.

7. Recommendations:

In light of these findings, the researcher recommends the following:

- Find a new approach to increase the maximum numbers of the kilim fabrics which produced in mass production in order to Create a new aesthetic features to emulate perfectly the hand-made kilims.
- Searching for new innovated materials could be produced in more heavy wiegths in order to give the produced fabrics the amended worm functions and the stability on the floor.
- Increasing the sustainable development with making the benefit from the hand-made crochet craft, however, it could be introduce the away out to many of the low-income families’.

8. References:

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