

INFLUENCE OF EMBROIDERY STITCHES ON THE PROPERTIES OF TEXTILE FABRICS

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ABSTRACT

The effect of adding stitches embroidery to clothes, in both hand and machine embroidery, has not received much attention from researchers. In this study we focus on the effect of embroidery stitches on the properties of fabrics. Three types of embroidery stitches (Satin - Couching – Crossed back) in the form of longitudinal mid-area samples of cloth are carried out with two methods (handmade and machine embroidery). Fabric properties (Weight per unit area, Thickness, Bending stiffness, Tensile strength and elongation) are the properties under the study. Results are statistically analyzed and discussed. A comparison between results of the two methods is done to clarify the advantages and disadvantages of each method.

KEYWORDS : Embroidery Stitches, Thickness, Weight Per Unit Area, Bending Stiffness, Tensile Strength & Elongation

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INTRODUCTION

Embroidery is the art of decorating fabric or other materials by stitching designs using thread or yarn and a needle. Hand embroidery involves stitching embroidery designs by hand onto the fabric. This process is time-consuming and painstaking, but produces amazing results.

The use of embroidery to decorate clothes has been known around since man began to wear clothes. A method of decorating and embellishing clothing, embroidered designs came about as a result of hard work and care. Embroidery as an art form has origins that can be traced far back to the Iron Age. Several excellent examples of beautiful embroidery work are still surviving till date. Samples can be found from Ancient Egypt, China, Persia, India and England. Style of embroidery incorporates the culture and imagery from history and tradition of every country [1]. Today, machine embroidery has grown by leaps and bounds. Computers have added another twist into this sewing technique making the process easier for mass production of embroidered designs. Nowadays, machines are available in the market which can embroider designs for you. Specially designed machines can even read a computerized design and stitch it for you. As a result of using the machine embroidery declined gradually the needlework art. Although this art of embroidery is still common, as a hobby and craft industry, practiced in every country in the world's workers, specialists or amateurs [2].

During modeling process garments show a different appearance than textile fabrics; thus due to the process of a assembling. This is based on stiffening, which is caused by assembling process and the change of material's mass throughout the fabric. Kind of assembling process such sewing, melting, fusing influence

essentially the appearance and properties of a textile fabric. Many studies have been carried out for examining the effect of sewing stitches and the fusing interlinings on the properties of fabrics, such as the bending stiffness and drapability. Results of studies the effect of seams on the bending stiffness indicate that, the seam leads to stiffening of the material, depending on both its number of layers in the seam section and the sewing thread consumption [3], [4], [5], [6]. SEIF [3] studied the effect of seam direction, seam types and seam positions. Based on the results, a function between distance from the seam and bending stiffness was determined. Influencing factor of the seams was calculated. The Knowledge of the seam's influencing factors makes the analytic determination of seam stiffness directly from bending stiffness value of a seamless fabric possible according to the suggested equations. Influence of the stitches pattern on deformation behaviour of woven fabrics was introduced by Bekampiene [7]. Fabric bending, shear, tension and buckling properties when specimens were reinforced by stitching were studied and the result shows that formability parameters of a fabric can be changed by performing seams. For the effect of fusing interlinings on the bending stiffness has SEIF [8] three different types of fusing materials (woven, nonwoven and knitted) investigated. Results showed that, bending stiffness increases when the shell fabric is fused to interlining, forming a composite fabric in the process. Comparing woven, knitted and nonwoven base fabric interlinings, bending stiffness was greatest when interlining with woven base fabric was used.

It was observed that, the influence of adding embroidery stitches on clothing, whether with handmade embroidery or using machine embroidery, have not a lot of consideration from researchers, although it depends on the same theory of the impact of garment assembly to change the thickness and weight of the cloth in the area of cloth embroidered and thus the fabric properties affecting the clothing appearance.

Aim of the Study

The aim of this study is to investigate the effect of some embroidery stitches, which are done in two different methods (handmade and machine) on the fabric properties (bending stiffness, thickness, tensile strength and elongation) and make a comparison between the different effects of the two methods (handmade and machine) to state the advantage and disadvantages of every method.

Hand Embroidery Stitches

Embroidery is decoration worked on the surface of the fabric using thread. It can be done by careful selection of design, embroidery stitches and colors and a very striking effect can be created. Old clothes can get a new lease of life by adding just a dash of embroidery. All basic embroidery stitches are easy. What may appear to be a difficult or complicated work is a result of a well thought out of plan. Several basic stitches can be combined to produce a rich embroidered piece.

We will describe the three types of embroidery stitches, which are chosen for this study. Satin Stitch, Couching stitch and Crossed back stitch [1].

Satin Stitch

It is basically a filling stitch. The thread is taken out in front and back equally. It gives a very smooth finish to the embroidery. These are straight stitches worked slantwise. For straight areas, work slantwise from top to bottom; for a small circle, work long stitches vertically, centre first, then fill each side; for leaf shapes, work diagonally, starting from the left edge (Figure 1-a).

Couching Stitch

It is clear from the name that it depends on a string on the fabric where the thread extends towards the fabric of the cloth and then inserts small equal probes in different distances. It can be used thick yarns or wool yarns then fixed string with another embroidery threads and a different color to look nicer (Figure 1-b).

Crossed Back Stitch

Crossed back stitch or shadow stitch on the right side is resembles two rows of backstitch and on the wrong side the catch stitch. Slant the needle the same as if making a catch stitch, make a single back stitch, first on the lower side and then diagonally across on the upper side. Work this stitch on transparent material so the crossing of threads shows through to right side. This stitch is often called herringbone stitch when are worked on right side (Figure 1-c).

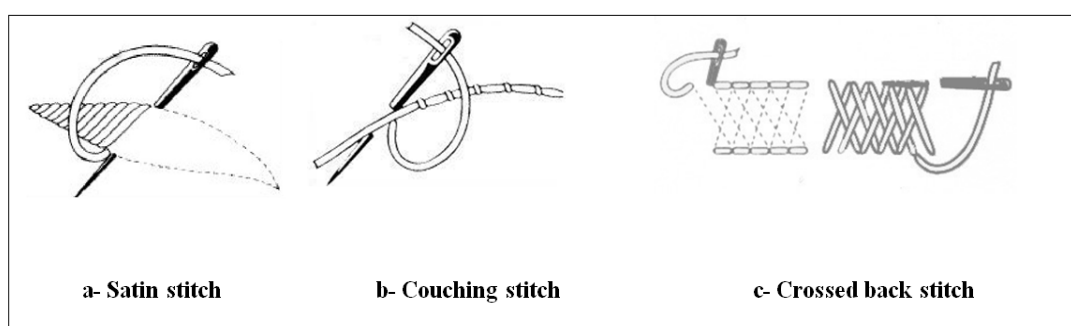


Figure 1: Investigated Embroidery Stitches [1]

MATERIALS AND METHODS

Plain weave 1/1 fabric with contents 65% PES, 35% CO. of 126 g/m², thickness 0.20 mm and density 32 Warps/cm and 28 Picks/cm was chosen for the investigation. Three types of embroidery stitches (Satin stitch, Couching stitch and Crossed back stitch) were applied on the fabric with two different methods (machine and handmade). The reason for selecting these stitches is that they can be produced by machine and handmade. For the crossed back stitch produced by machine, we select a motive stitch, which is look like the crossed back stitch. Investigated embroidery stitches were shown in figure 1. For machine embroidery two levels of stitch density, distance between every sequent penetration of the needle, 0.4 mm and 0.8 mm were used. Embroidery thread (Rayon) Number 120 D/L was used for the two methods. The Embroidery stitches were in the form of longitudinal mid-area of the samples with Column width 0.8 mm and carried out for both handmade and machine embroidery.

For all fabric samples physical properties (bending stiffness - thickness - weight per unit area) and mechanical properties (tensile strength and elongation) were tested. Shirley stiffness device is used to carry out the bending length and the bending stiffness is calculated according to DIN (53362). The tensile strength and elongation test is tested according to ASTM (D5035-95).

The Pilling resistance was tested for all samples according to ASTM (D4970), but the results indicate that no pilling was occurred at the surface of all embroidered samples. This result refers to the embroidery threads, which are equipped with a shiny surface through the burn pile or add a waxy substance. For that reason we did not give a lot of attention to result of this test in the discussion.

RESULTS AND DISCUSSIONS

Effect of Embroidery Stitches on the Weight per Unit Area and the Thickness of Fabrics

As mentioned in the experiments, samples are embroidered with handmade and machine. For the method of machine embroidery two varieties are done and tested, distance 0.4 mm and 0.8 mm. The results pointed that, both of the weight per unit area and the thickness are bigger by the level of 0.4 mm than the level of 0.8 mm in general for the three stitches. It is obvious that the satin stitch records the highest value, then the couching stitch and at the end comes the crossed back stitch. For the crossed back stitch, we could not control the two levels (0.4 mm and 0.8 mm), we tried to make the two levels by making (thick and light density), and so the result of this stitch brings inconstant influence for all the tested fabrics.

To make a comparison between the influences of the handmade embroidery and machine embroidery on the weight per unit area and the thickness we choose the results of the distance 0.8 mm from the machine, since the appearance of it is close to the appearance of the handmade embroidery. The result is shown in figure 2 and figure 3. They confirm that, the both of the weight and the thickness are increased by adding the embroidery stitches in general. Satin stitch recorded the highest value then the couching stitch and at the last the crossed back stitch. It is obviously that the handmade embroidery caused more increasing in the weight and the thickness of fabrics than the machine embroidery. It can be referred to the evenness of the machine embroidery than the handmade also because of the constant tension of the threads than the handmade, which make the appearance of the handmade embroidery more thick than the machine embroidery. The correlation factor for the weight per unit area is (0.95) for handmade embroidery and (0.78) for the machine embroidery. For the thickness of the fabrics recorded the correlation factor for the handmade (0.99) and for the machine embroidery (0.95). The linear regression equations confirm these results very well.

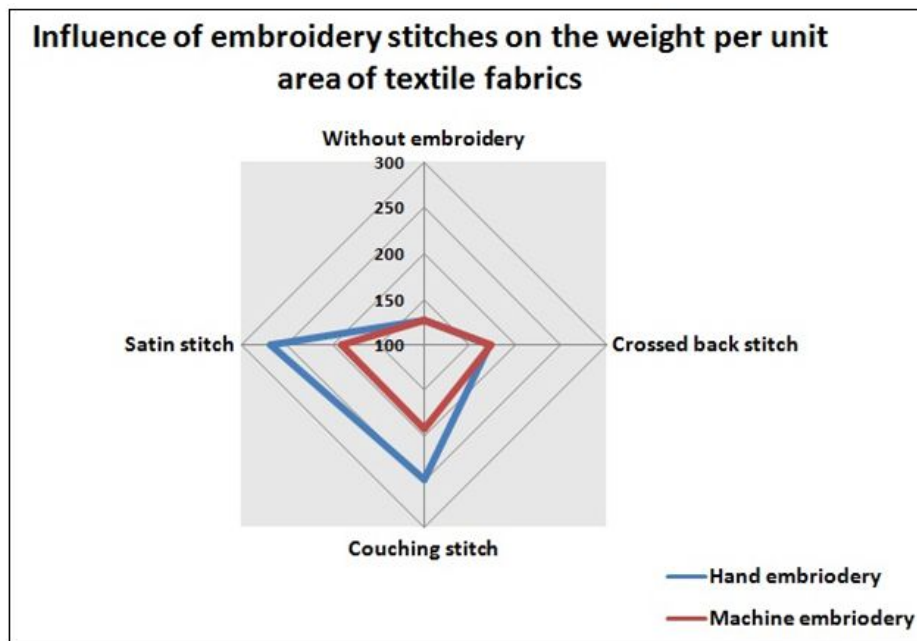


Figure 2: A Comparison between the Influence of Handmade Embroidery and Machine Embroidery on the Weight per Unit Area of Fabrics

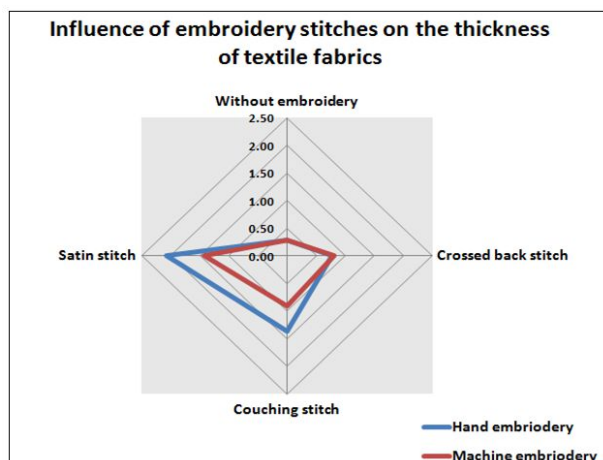


Figure 3: A Comparison between the Influence of Handmade Embroidery and Machine Embroidery on the Thickness of Fabrics

Effect of Embroidery Stitches on the Bending Stiffness

Fabric is embroidered with three different stitches with machine in two levels (0.4 mm and 0.8 mm). Results confirm that in general the embroidery stitches increase the bending stiffness of the fabric. It is clear that the bending stiffness by the level 0.4 mm is higher than by 0.8 mm; because of the stitch density increased the weight of the fabric and the cross points also, which leads to increasing in the bending stiffness.

Result of the bending stiffness of the fabric, with handmade embroidery and machine embroidery (0.8 mm), is analyzed to make a comparison between the influences of the two methods. In figure 4 the influence of the embroidery stitches on the bending stiffness is shown. It is obviously that the values of the machine embroidery are higher than the handmade embroidery in general. Because of the constant tension of the embroidery threads by the machine and the evenness of the stitches, stitches become stiffer. Results show also that the satin stitch has the higher bending stiffness value by the two methods, then the couching stitch and finally comes the crossed back stitch with the lowest value of the bending stiffness. The correlation factor for the hand embroidery is (0.87) and for the machine embroidery is (0.92), and the linear regression equations confirm the relationship for the tested stitches.

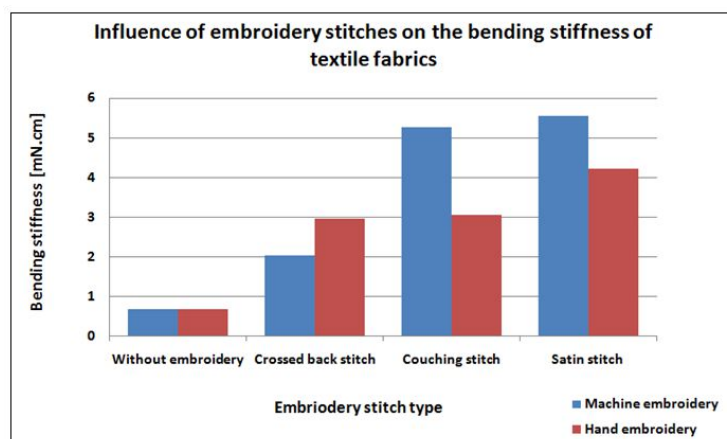


Figure 4: Influence of Embroidery Stitches on the Bending Stiffness of Fabrics (Handmade Embroidery and Machine Embroidery)

Effect of Embroidery Stitches on the Tensile Strength and Elongation

As noted in the experiments, the fabric is embroidered with using two methods (handmade and machine), for the machine two levels are used (0.4 and 0.8 mm) and the results indicate that the embroidery stitches caused a decrease in the tensile strength in general and increase in the elongation. By level of 0.4 mm recorded the tensile strength and the elongation a higher values than by the level of 0.8 mm. it is because of the increase of the stitch density.

Result of the tensile strength refer to that the influences of the three stitches on the fabric seem to be equal. There is a little increase by the satin stitch rather than the couching stitch and crossed back stitch. Overall present the machine embroidery stitches a significant effect by reducing the tensile strength than the handmade embroidery. The correlation factor is (0.59) by the handmade embroidery and (0.75) by the machine embroidery. This result may be due to the same explanation of the bending stiffness, thickness and weight per unit area. Because of the unevenness of the handmade embroidery stitches, more stitches can be built at the same line, which caused more strength than what was expected (Figure 5).

For the elongation test show the result that the embroidery caused an increase in the extensibility of the stitch line. Overall affect both handmade and machine stitches the fabric equal. Machine embroidery shows a little higher value than handmade embroidery, which may be due to the evenness of the stitches and the constant tension of the threads. Also the three tested stitches indicate closed values of the elongation. The correlation factors record by handmade embroidery (0.67) and by machine embroidery (0.99). Results of the elongation are shown in figure 6.

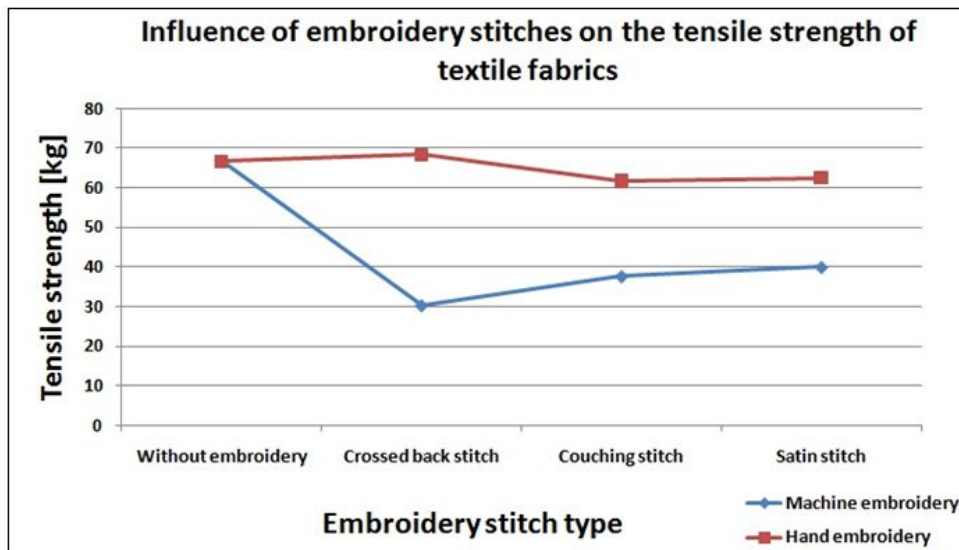


Figure 5: Influence of Embroidery Stitches on the Tensile Strength of Fabrics

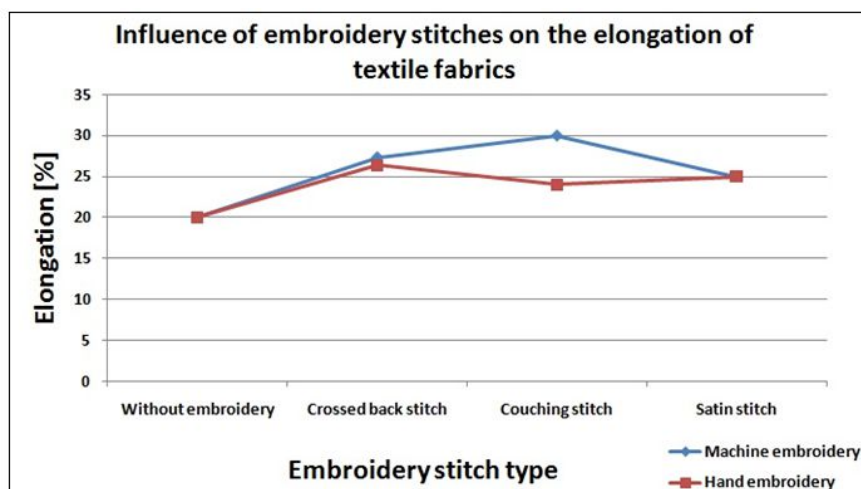


Figure 6: Influence of Embroidery Stitches on the Elongation of Fabrics

CONCLUSIONS

This study investigates the influence of adding embroidery stitches on fabric properties, which affect directly the appearance of clothing garments. Handmade embroidery stitches and machine embroidery were applied on textile fabrics to make a comparison between the two methods.

Embroidery stitches caused a decrease in the tensile strength in general and increase in the elongation. For machine embroidery recorded the tensile strength by 0.4 mm higher values than by the level of 0.8 mm. It is because of the increase of the stitch density.

At the opposite adding stitch embroidery to the fabric caused a decreasing of the tensile strength of the fabric. Overall present the machine embroidery stitches a significant effect by reducing the tensile strength than the handmade embroidery.

Results show, that embroidery stitches caused an increase in the extensibility of the stitch line. Overall affect both handmade and machine stitches the fabric equal. Machine embroidery shows a little higher value than handmade embroidery, which may be due to the evenness of the stitches and the constant tension of the threads.

Handmade embroidery stitches have a higher effect on the fabric properties than the machine embroidery for all properties under the study except the bending stiffness. That can be referred to the unevenness of the handmade embroidery.

With using a machine embroidery record the bending stiffness higher values than handmade embroidery, because the constant tension of the threads, which leads to more stiff of stitches.

At the end, it can be said that, embroidery stitches increase all of the weight per unit area, the thickness, the bending stiffness and the elongation of the textile fabrics.

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