The Study of the effect of the juxtaposition of specific materials on some seam properties

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Abstract: In this articles three different types of fabrics (satin, Chiffon & Tulle) were sewn together for wedding and Soiree dresses, different needle counts were selected to study seam strength, slippage, and bending length and other properties. The seam was carried out with only stitch type (301) with different stitch densities per cm (3,4, and 6) three levels of needle count stitch type (12, 14 and 16) were chosen for this study.
A full factorial design 3*3*3 was used in this research. All other parameters were constant. The sewing thread used was Ne 40/2.
The results are analyzed by using the program of (STATISTICA), as, multiple regression's' test.
The factors which have significant effect on the measured parameters were plotted and drawn as three dimension diagrams to demonstrate the shape of the relations of the dependent and independent parameters.
It was found that the the suitable fabrics for Wedding and Soiree dresses must be sewn from (Satin and Chiffon), because of the high seam strength.
To get high elongation and drape, it is better to be sewn from (Chiffon and Tulle).
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Key words: Chiffon, Tulle, satin, seam properties, seam pucker, soiree dress, needle count, stitch density.

1 - Introduction

Chiffon is a wonderful lightweight fabric, and it is generally used in soiree evening, wedding dress, and formal wear, so it drapes well and can add a floaty look to gowns and dresses. This fabric is a plain woven sheer fabric with a soft elegant drape.

Chiffon is a textile may be made from silk, cotton, nylon, polyester, or rayon. When held up to the light, chiffon strongly resembles closely woven netting. The name comes from an old French word for rag. As a general rule, chiffon is used primarily in women's clothing, because the fabric does not lend itself well to men's designs. In addition to being used in things like dresses and skirts, chiffon velvet also shows up in scarves, hats, sashes, purses, and other accessories. In formal wear, chiffon is often used as an overlay over more opaque fabrics

The wedding and evening dresses which made from Chiffon, Tulle and Satin are very difficulty during sewing processes, due to the high drape ability of the used fabric as chiffon, tulle and satin.

When sewing chiffon, many crafters layer tissue paper in between two piece of chiffon being sewn together, after sewing, the tissue paper can be carefully ripped out.

It means that the, it is difficult to sew two pieces of chiffon together; chiffon must be sewed with other materials as Satin or Tulle. During sewing, one should work slowly and steadily with chiffon. Because chiffon has a tendency to unravel, it is very important to bind the seams to keep them secure, as otherwise the garment may start to fray at the seams and ultimately come undone. It is also notoriously difficult to sew with, because of the slippery texture of the fabric.

2 - Review of literature

Chiffon is a nearly transparent fabric made with a plain weave, it was originally made of silk, but today is often of rayon, silk, nylon and other synthetic fibers. Chiffon is light and airy, resulting in a crepe-like texture. Drapes beautifully, falling in soft, languid ripples, it's currently popular for evening wear and layered skirts (Jennifer Smith, 2008).

Because softer fabrics like chiffon are more fragile, can be easily distorted, and are susceptible to snags, they are the most difficult to sew

Chiffon is most commonly used in evening wear, especially as an overlay, for giving an elegant and floating appearance to the gown. It is also a popular fabric used in blouses, ribbons, scarves and lingerie. Like other crepe fabrics, chiffon can be difficult to work with because of its light and slippery texture (Kadolph, Sara J., 2007).

Satin is a weave that typically has a glossy surface and a dull back, it is usually a warp-faced weaving technique in which warp yarns are "floated" over weft yarns, although there are also weft-faced satins.(Cumming, Valerie; Cunnington, C.W.; Cunnington, P.E. 2010). If a fabric is formed with a satin weave using filament fibres such as silk, nylon, or polyester, the corresponding fabric is termed a satin, if the yarns used are short-staple yarns such as cotton, the fabric formed is considered a sateen (Emery, Irene,1994).

A satin fabric tends to have a high lustre due to the high number of floats on the fabric. Because of this it is used in making soiree dresses. Satin weaves, twill weaves, and plain weaves are the three basic types of weaving by which the majority of woven products are formed.

Satin is commonly used in apparel, women's lingerie, nightgowns, blouses, and soiree dresses (Shaeffer, Claire, 2008).

Satin is a beautiful, drapey fabric often used for formal wear. But it can be difficult to sew with because it is slippery and delicate.

The seam performance and quality depend on various factors such as seam strength, seam slippage, seam puckering, seam appearance.

Light weight fabrics are often difficult to sew. The biggest problem here is seam pucker. While sewing or after a short while thereafter, the material along the seams starts to look a bit rippled. Remedying the pucker by ironing or pressing is usually a temporary solution. After first laundering at the latest, the pucker is back. (Amann,Soehne GmbH , Co. KG).

Tulle is netting of textile made from silk, rayon, nylon, or sometimes cotton. It is woven in a mesh pattern, and often starched so that it will be stiff. The name comes from Tulle, a city in the southern central region of France. Tulle was well known as a centre of lace and silk production in the 18th century, and early tulle netting probably originated in this French city. Tulle netting certainly appeared earlier in Parisian ballet costume than in most other nations. There are numerous uses for tulle, although the most famous are probably tutus, wedding gowns, and veils.

One of the most common uses for tulle netting is in garments. Tulle is often used as an accent, to create a lacy, floating look. Tulle may also be used in underskirts or petticoats to create a stiff belled shape. Gowns are often puffed out with the use of several layers of stiff tulle.

Tulle netting is also used to make veils, since it obscures the features of the face while allowing the wearer to see out. Feel free to wrap tulle wedding decorations around the framework of the wedding arch. This fabric is ideal and will look attractive and elegant. Tulle is also durable, and when firmly pinned into place, is unlikely to appear droopy or limp as the hours go by.

The visual and appearance of the soiree dresses are a principal factor deciding its value. Seam pucker has been regarded as one of the most important parameter of quality of soiree dresses.

As defined in Oxford Dictionary, seam pucker is a ridge, wrinkle, or corrugation of the material or a number of small wrinkles running across and into one another, which appear in sewing together two pieces of cloth. It is usually caused by improper selection of sewing parameters and material properties, which results in unevenness on fabrics being stitched together, thus impairing their aesthetic values (Mark, K.L. and W. Li, 2008).

Seam puckering refers to the gathering of a seam during sewing, after sewing, or after laundering, causing an unacceptable seam appearance. Seam puckering is more common on woven fabrics than knits; and it is prominent on tightly woven fabrics. Puckering is usually caused by one or more of the following conditions.

• Yarn Displacement (structural jamming of fabric yarns).
• Tension Puckering (excessive thread tension and recovery).
• Machine Puckering (uneven ply feeding).
• Shrinkage (where seam components have differential shrinkage).

Seam Strength of a sample refers to the force acting upon a seam, at the time of fabric failure along the line of needle penetration.

A large number of studies(Shimazai K.,1979Mohanta R.A.,) have determined the seam strength according to ASTM 1683-04 standards, which express the valueof seam strength in terms of maximum force (in Newton (N)) to cause a seam specimen to rupture.

This is measured by using the following equation: $S_s = KS_b$

Where: S_s= sewn seam strength (N); K = a constant equal to 1000 for SI units; S_b = observed seam breaking force (N).

There are various factors which can affect the seam strength and seam appearance. Many previous studies [11,12] showed that seam appearance and performance depend on the interrelationship of fabrics, the stitch, the needle size, stitch density, the appropriate operation and maintenance of the sewing machines (Behera B.K., Shakun S., Snrabhi S. and Choudhary S,2000) .

The combination of materials that are assembled with the sewing thread and sewing conditions vary from individual to individual.

Selection of sewing thread and sewing condition for a particular type of material is an integral part of producing a quality seam (Mukhopadhyay A., Sikka M. and- Karmakar A.K,2004).

3 - Materials and Methods

Different fabric materials, textile which were used in this study, three levels of needle counts were selected also with different stitch densities.

The following parameters were studied:

1 – Fabric types, Satin (5), Chiffon (plain weave 1/1) and Tulle.
2 - Needle count (12, 14 and 16), SUK.
3 - Stitch density per cm (3, 4 and 6).
4 - Stitch type (301) was used in all experimental trials.

Table (1) actual and coded values of the factorial experiment.

Factors	Levels		
	1	2	3
Fabric Type	Satin + Chiffon	Satin + Tulle	Chiffon + Tulle
SeamNeedle Count	12	14	16
Stitch Density/cm	3	4	6

A full factorial design 3*3*3 was used in this research. All other parameters were constant. The sewing thread was Ne 40/2.

Plan of work:

Table (2) shows full factorial design 3*3*3 (27) trials which were carried out for all experiments as following:

Exp. Nr.	Levels			Needle Count	(stitch/cm)	Fabric Type	Exp. Nr.	Levels			Needle Count	(stitch/cm)	Fabric Type
1	1	1	1	12	3	Satin + Chiffon	15	2	2	3	14	4	Chiffon + Tulle
2	1	1	2	12	3	Satin + Tulle	16	2	3	1	14	6	Satin + Chiffon
3	1	1	3	12	3	Chiffon + Tulle	17	2	3	2	14	6	Satin + Tulle
4	1	2	1	12	4	Satin + Chiffon	18	2	3	3	14	6	Chiffon + Tulle
5	1	2	2	12	4	Satin + Tulle	19	3	1	1	16	3	Satin + Chiffon
6	1	2	3	12	4	Chiffon + Tulle	20	3	1	2	16	3	Satin + Tulle
7	1	3	1	12	6	Satin + Chiffon	21	3	1	3	16	3	Chiffon + Tulle
8	1	3	2	12	6	Satin + Tulle	22	3	2	1	16	4	Satin + Chiffon
9	1	3	3	12	6	Chiffon + Tulle	23	3	2	2	16	4	Satin + Tulle
10	2	1	1	14	3	Satin + Chiffon	24	3	2	3	16	4	Chiffon + Tulle
11	2	1	2	14	3	Satin + Tulle	25	3	3	1	16	6	Satin + Chiffon
12	2	1	3	14	3	Chiffon + Tulle	26	3	3	2	16	6	Satin + Tulle
13	2	2	1	14	4	Satin + Chiffon	27	3	3	3	16	6	Chiffon + Tulle
14	2	2	2	14	4	Satin + Tulle							

Table (3) shows the details of the specifications of fabrics used for soiree and wedding dresses.

Fabric type	Structure	Weight (g/m^2)	Warp / cm	Weft / cm
Satin	Atlas (5)	160	80	25
Chiffon	Plain Weave	50	45	31
Tulle		20		

It is clear from table (3) which shows the variance in the weight of fabric , the satin fabric used as basic but the chiffon and tulle were used as cover fabric or decorative.

The samples were seamed as shown in the experimental plan in the National Research Centre, Dept. of Clothing and Knitting, Cairo.

Then all samples were put in the same laboratory conditions 24 hours, and then tested in the same conditions.

In the present study, seam strength, seam elongation, automatic break of seam, elongation at automatic break, stresses and seam pucker were tested.

In this article, the seam pucker, was measured according to(AATCC88 – 2008).

The other properties were tested with reference to (ASTM D5035 – 2011), the Instron Model 3340 Tensile Testing Machine was used to measure the seam strength, seam elongation, automatic break of seam, elongation at automatic break, stresses, in the department of clothing and knitting, National Research Centre. The rresults are analyzed by using the program of (STATISTICA), as, multiple regression,'t' test. The factors which have significant effect on the measured parameters were ploted and drawn as three dimension diagrams to demonstrate the shape of the relations of the dependent and independent parameters.

4 - Results and Discussion:

4 – 1 - Seam Strength

4 -1 -1 Effect of types of materials on the seam strength:

The performance and appearance of seams form is an important component of the quality of the wedding dress.

The seam strength of all specimens for every each fabric weave structure apparently influenced with fabric weight. There is a significant relationship between types of fabrics and seam strength.

Table (4) shows that the multiple correlation factor for seam strength = 0,86334852 at significant level 100 %. The coefficient of determination is about = 0,74537066. It means that the obtained

regression model could explain 74,53% of the variations for this case.

The rest of analysis shows that the material of fabric has significant factor 100%, the other parameters have no significant effect in the range of experimental levels.

It is clear from fig. (1) That the types of materials have a significant effect, but the seam strength at all levels of stitch density still constant and about 2 kg.f.

Table (4) shows the regression summery of seam strength

Multiple Regression	**Regression Summary for Dependent Variable: Seam Strength** R= .86334852 R²= .74537066 Adjusted R²= .71215814					
N = 27	BETA	St. Err. of BETA	B	St. Err of B	t(23)	p-level
Intercept			15.05948	2.005123	7.51050	.000000
NEDDLE	-.010178	.105218	-.05450	.563391	-.09674	.923774
DENSITY	-.040744	.105218	-.21817	.563391	-.38724	.702140
MATERIAL	-.862326	.105218	-4.61733	.563391	-8.19561	.000000

The other parameters have no significant effect on the seam strength.

The maximum seam strength occurs at the level (1) of materials [Satin + Chiffon], and it was 12 kg.f., but the minimum occurs at the level (3) of material [Chiffon + Tulle], and about 1,849 kg.f.

It means that, the types of two different materials play an important roll at the seam strength.

During test observation of seam strength, the breaking occured always at the seam area of joint the two pieces of satin fabric and chiffon fabric. But with the other levels of fabrics the breaking occured at the fabric, far from seam area, due to:

a - the high variance of elongation between the warp knitting fabric [Tulle] was 120 % and textile fabrics [satin and chiffon] were 41% and 25 % respectively.

b- The variance of weight between three fabrics.

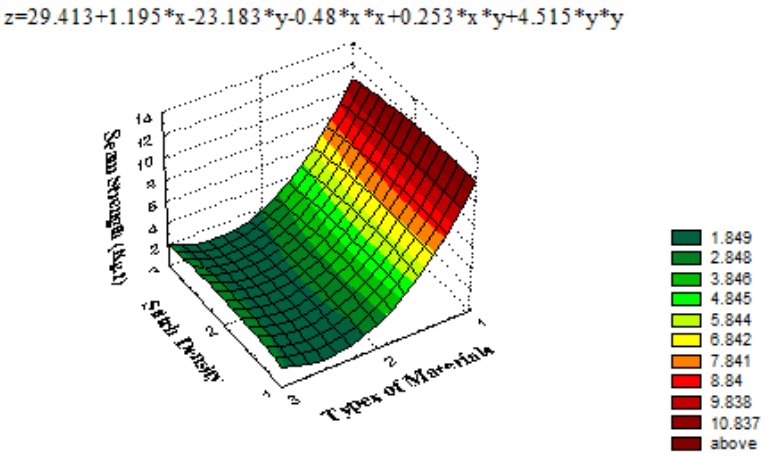

Fig (1) Shows the effect of types of materials and stitch density on seam strength.

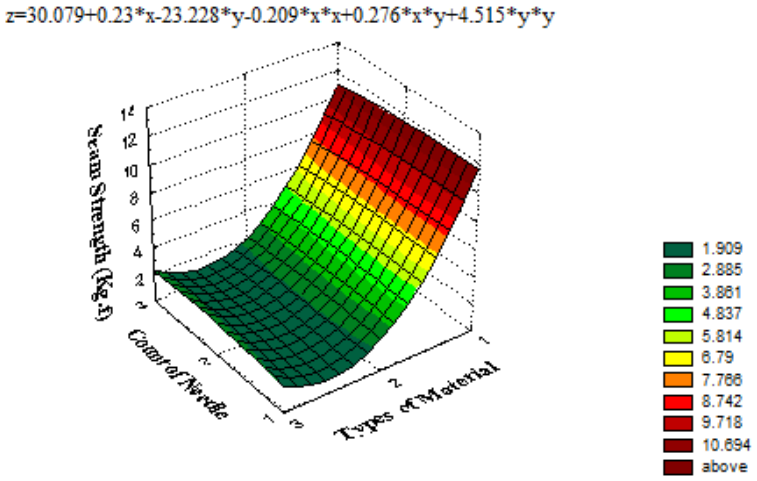

Fig. (2) Shows the effect of types of materials and count of needle on seam strength.

The two figures (1, 2) .agree with the results from statistical analysis in table (4) for the parameters which have significant effect (types of materials) and non-significant effect (stitch density and count of needle)

4 – 2 – Seam Elongation

4 -2 -1 Effect of Fabric Type on the Elongation

Table (5) shows the regression summery of Elongation

Multiple Regression	**Regression Summary for Dependent Variable: EEAM ELONG%** R= .78399050 R²= .61464111 Adjusted R²= .56437690					
N = 27	BETA	of BETA	B	of B	t(23)	p-level
Intercept			30.33104	9.271094	3.271570	.003352
NEDDLE	.099722	.129440	2.00689	2.604953	.770413	.448897
DENSITY	-.095438	.129440	-1.92067	2.604953	-.737313	.468387
MATERIAL	.771744	.129440	15.53117	2.604953	5.962169	.000004

Table (5) shows that the multiple correlation factor for elongation at break = 0,7839905 at significant level 99.995%. The coefficient of determination is about = 0,61464111. It means that the obtained regression model could explain 61.46 % of the variations for this case.

The rest of analysis shows that the material of fabric has significant factor 99.9996%, the other parameters have no significant effect in the range of experimental levels.

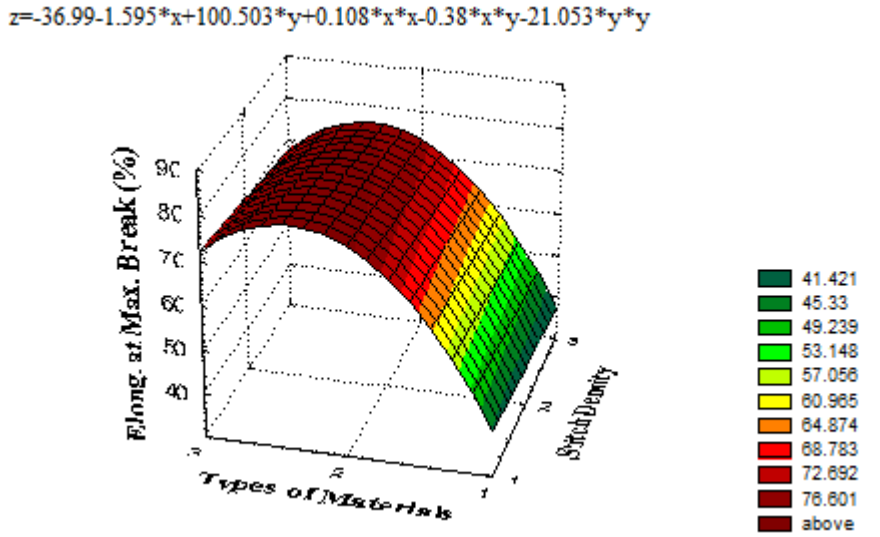

Fig (3) Shows effect of .types of materials and stitch density on seam elongation % at break

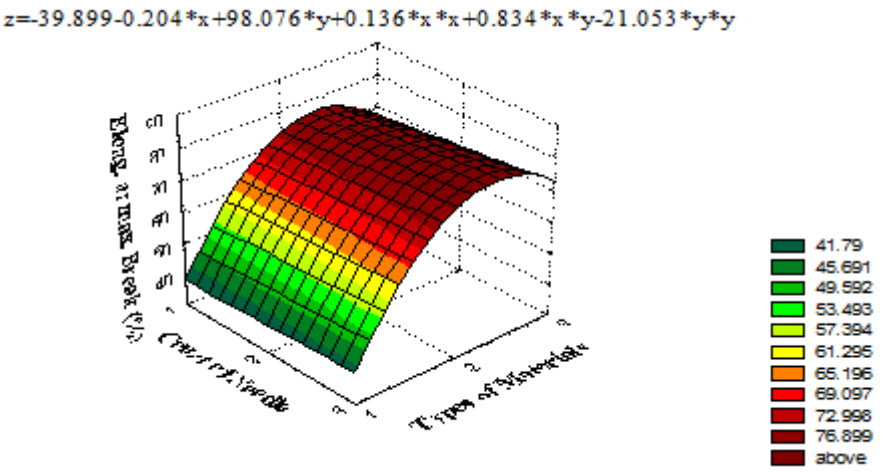

Fig. (4) Shows the effect of .types of materials and count of needle on seam elongation % at break

Seam elongation is an important factor of seam durability, because it helps to prevent sudden rupture at the area of seam during end use.

Fig (3) Shows effect of .types of materials and stitch density on elongation % at break, it is clear that the elongation % is constant with all levels of stitch density, because from the statistical analysis, this factor has no significant effect.

But the types of fabric has significant effect, the elongation is changed from level to level of fabric types, the min. at level 1 ((stain + chiffon) the maximum at level 3 (chiffon + tulle).

Fig (4) Show the effect of .types of materials and count of needle on elongation % at the break, the behaviour and the trend of fig. 4 is as the same of fig. 3.

Figures (3, 4) .agree with the results from statistical analysis in table (5) for the parameters which have significant effect (types of fabric) and non-significant effect (stitch density and count of needle).

4 – 3 – Seam Pucker

4 -3 -1 Effect of Stitch Density on Seam Pucker

Table (6) shows the regression summery of Seam Pucker

Multiple Regression	Regression Summary for Dependent Variable: **Seam Pucker** R= .49771688 R²= .24772210 Adjusted R²= .14959889					
N = 27	BETA	of BETA	B	of B	t(23)	p-level
Intercept			4.037037	.865138	4.66635	.000107
NEDDLE	.000000	.180853	.000000	.243083	.00000	1.000000
DENSITY	-.495998	.180853	-.666667	.243083	-2.74255	.011600
MATERIAL	-.041333	.180853	-.055556	.243083	-.22855	.821242

Table (6) shows that the multiple correlation factor for Seam Pucker= 0,49771688 at significant level 99.2 %. The coefficient of determination is about = 0,2477221. It means that the obtained regression model could explain 24.77% of the variations for this case.

The rest of analysis shows that the stitch density has significant factor 99%, the other parameters have no significant effect in the range of experimental levels.

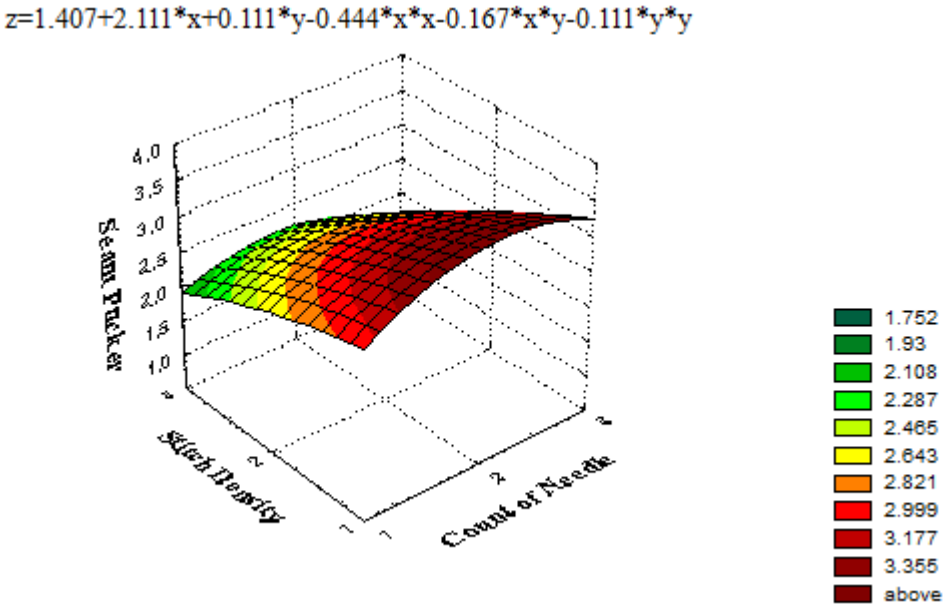

Fig. (5) Shows the effect of .Stitch Density on Seam Pucker.

It is clear from fig. (5) That stitch density has significant effect on seam pucker, with the increasing the stitch density, the seam pucker will increase also. The significant level between seam pucker and stitch density is 99%.

4 -3 -2 Effect of Fabric Type and Stitch Density on Seam Pucker

Fig (6) shows the effect of types of materials on seam pucker, it is clear that the types of fabrics play an important role on seam pucker.

In this study, three different of fabrics were used. The seam pucker is increasing at level (Satin + Chiffon) and level 2 (Satin + Tulle) of fabric type, because the density of satin fabric is 160/cm

in warp direction and 80/cm in weft direction, and higher than other fabrics.

So to avoid seam puckering, it must be used suitable fabric density to get good appearance, drape without seam pucker.

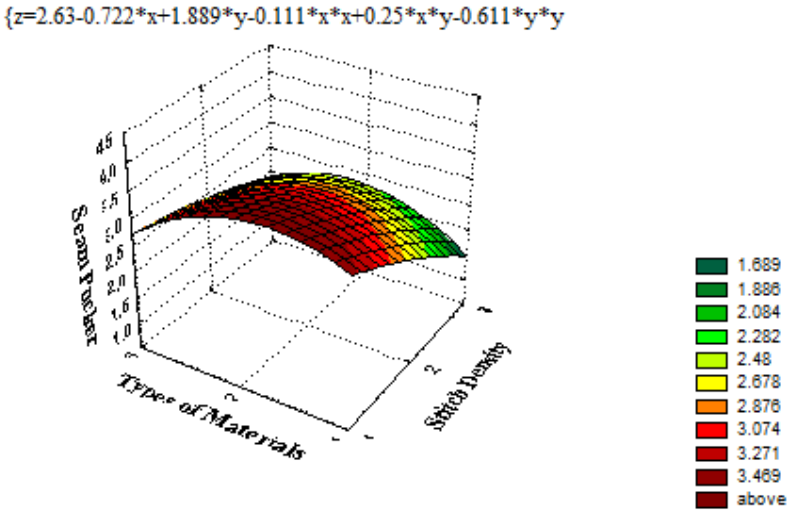

Fig (6) Shows the effect of .Types of Materials on Seam Pucker.

4 -3 -3 Effect of Needle Count on Seam Pucker

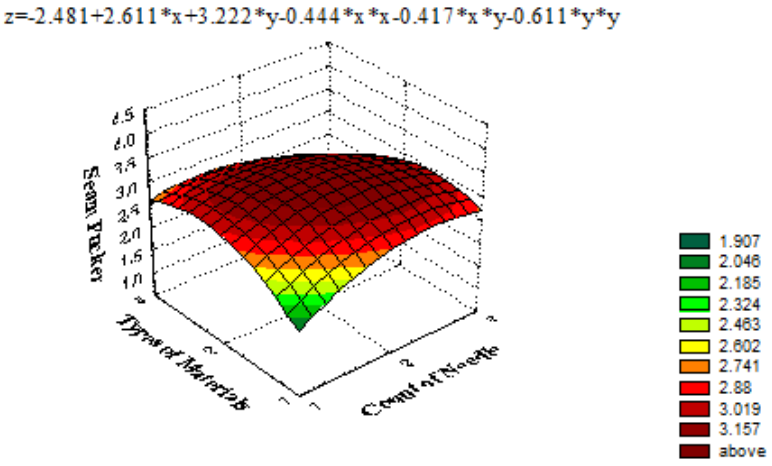

Fig (7) Shows the Effect of Needle Count on Seam Pucker.

Fig (7) shows the effect of needle count on seam pucker, it is clear that count or thickness of needle has significant effect on seam pucker.

By increasing the level of needle (count of needle), the seam pucker will increase also, the count 16 has maximum seam pucker, because it takes much area during sewing processing and makes the threads of fabric much density, and creates seam pucker.

4 – 4 – Stress

4 -4 -1 Effect of types of materials on stress

Table (7) shows the regression summery of Stress

Multiple Regression	**Regression Summary for Dependent Variable: STRESS** R= .86813188 R²= .75365297 Adjusted R²= .72152075					
N = 27	BETA	of BETA	B	of B	t(23)	p-level
Intercept			.300444	.039676	7.57244	.000000
NEDDLE	-.007221	.103493	-.000778	.011148	-.06977	.944981
DENSITY	-.032492	.103493	-.003500	.011148	-.31396	.756383
MATERIAL	-.867494	.103493	-.093444	.011148	-8.38217	.000000

Table (7) shows that the multiple correlation factor for Stress = 0,86813188 at significant level 100 %. The coefficient of determination is about = 0,75365297. It means that the obtained regression

model could explain 75,36 % of the variations for this case.

The rest of analysis shows that the type of material has significant factor 100%, the other parameters have no significant effect in the range of experimental levels.

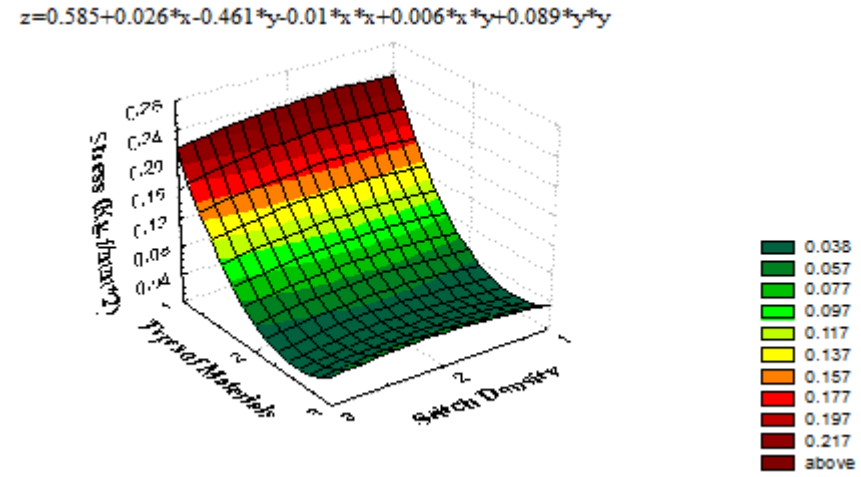

Fig (8) shows the Effect of types of material and stitch density on Stress.

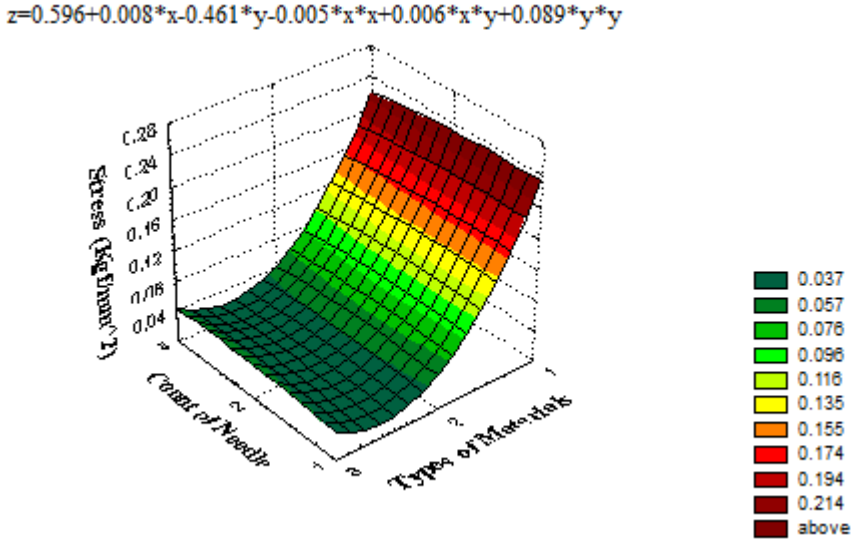

Fig (9) shows the Effect of types of material and stitch density on Stress.

During the end use of wedding and soiree dresses, they are exposed to repeated mechanical stresses as tensile, extension and other stresses.

Fig. 8 shows the effect of both material type and stitch density on stresses, it is clear that the stitch density has no significant effect, but only the material type has high significant effect 100 %.It is clear that the materials (satin and chiffon) when sewn together can achieve high stresses.

So these materials can avoid high stresses during wear.

Fig. 9 shows the effect of both material type and count of needle on stresses, it is clear that the stitch density has no significant effect, but only the material type has high significant effect 100 %.It is clear that fig. 9 has the same trend and behaviour as fig. 8.

5 - Conclusion:

In this study, different types of fabric were sewn together for wedding and soiree dress, some independent factors were used in this study as fabric type, needle count and stitch density.

The other dependent parameters were measured and analyzed with STATISTICAL programme.

The conclusions drawn are shown as follows.

1- The types of materials have significant effect on the seam strength, but the other parameters has no significant effect.
2- The maximum seam strength was found by sewing satin and chiffon together.
3- For the elongation, the type of material plays an important roll at this property, the other parameters as no significant effect.
4- The maximum elongation was achieved by sewing chiffon and tulle together.

5- The stitch density has significant effect on seam pucker, the maximum seam pucker meets with the stitch density 6/cm.
6- The count of needle has significant effect on seam pucker, the maximum; pucker meets with needle count 16.
7- The material type has significant effect on the stresses, the maximum stresses meets with the fabric satin.

References

(1) Understanding Fabrics, A Guide to Understanding Fabrics, Editor: Jennifer Smith, Copyright © 2008 Learning Seed.
(2) Kadolph, Sara J., "Difference between Chiffon and Georgette" 10th edition, 2007, ISBN 0-13-118769-4, p. 230.
(3) Cumming, Valerie; Cunnington, C.W.; Cunnington, P.E. (2010). The dictionary of fashion history. Oxford: Berg. p.231. ISBN1847887384.
(4) Emery, Irene (1994). The Primary Structures of Fabrics.Washington, D. C. Thames and Hudson.p. 137.ISBN 978-0-500-28802-3.
(5) Shaeffer, Claire (2008). Claire Shaeffer's fabric sewing guide (2nd ed. ed.). Cincinnati, Ohio: Krause Publications. p. 238.ISBN1440223424.
(6). Amann&Soehne GmbH & Co. KG, www.amann.com, Prevention of seam pucker
(7) Mark, K.L. and W. Li, 2008."Objective evaluation of seam pucker on textiles by using self-organizing map". IAENG Int. J. Comp. Sci., 35.
(8). Shimazai K., Studies on seam strength- tensile strength of seam sewed by hand, Japanese Resource Association of Textile End-Uses, 20, 317-327 (1976)
(9). Mohanta R.A., study on the influence of various factors on seam pe
(10). Behera B.K., Shakun S., Snrabhi S. and Choudhary S., Comparative assessment of low stress mechanical properties and sewability of cotton and cotton banana union fabric, Asian Textile Journal, 9(5), 49-56 (2000)
(11) Mukhopadhyay A., Sikka M. and- Karmakar A.K., Impact of laundering on the seam tensile properties of suiting fabric, International Journal of Clothing Science and Technology, 16(4), 394-103 (2004
(12) AATCC Test Method 88B - 2001, Smoothness of Seams in Fabrics after Repeated Home Laundering.
(13) ASTM D5035 - 2011 – Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).