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Drape Behaviour Of Silk Apparel Fabrics With Radial Seams

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Abstract

Drape is unique property that allows a fabric to be bent in more than one direction describing a sense of graceful appearance. Silk fabrics world over are known for their unique functional and aesthetic properties. Sewing is an important step in converting pieces of fabrics into a garment. Fabric drape is more realistically investigated by considering seams. This paper presents a fundamental drape analysis of radially seamed fabrics, using cusick's drape meter.Plain silk fabrics with various GSM values are given radial seams. The effects of seam allowance are investigated experimentally. The drape coefficients (DC%) for fabrics with one radial seam are rather stable, but with two seams there is a drop in DC% especially marked for heavy fabrics.

1 Introduction

Drape describes the ability of the textile material to orient itself into graceful folds under gravity. Practically, drape or lack of it determines the ultimate fabric quality for apparel design for specific end uses.

Silk fabrics world over are known for their unique functional & Aesthetic properties. Silk fabrics are used for depicting Grace/luxury and Drape is a very important component of this. Sewing is an important step in converting pieces of fabrics into a garment, and seaming is believed to influence garment appearance. In this scenario sewing assumes greater importance as; silk fabrics need extra care in converting them into beautiful pieces of grace/luxury.

Three dimensional drape studies by Chu [1] established a measuring method for fabric drape. Chu quantified the drapeability of the fabric into a dimensionless value he called "drape coefficient." Finally, Cusick [2] investigated the experimental method by using a parallel light source that creates the drape shadow of a circular specimen from a pedestal on to a piece of ammonia paper. He also modified the calibration of Chu's drape coefficient in terms of paper weighting method.

Seaming is the most fundamental way of converting the pieces of fabrics into garments. Investigating the effect of seams on fabric drape has a significant value for textile and garment industries. A real seam sewn on a fabric is the best method for studying its effect on fabric drape, but relevant research on the drape of seamed apparel silk fabrics is very limited. In this prêt-a-porter era there is renewed interest in silk fabrics rightly called as 'Queen of textiles'. The sheer and gossamer nature of silk and the natural origin of the fiber make it an interesting subject for researchers worldwide. Apparel fabrics need to have best fit and the ability of the fabric to drape assumes importance. Seaming is one of the fundamental parts of garmenting techniques and it is known to influence the garment fit. A plain seam, the most typical seam found extensively in garment, is the simplest type in which a single row of lockstitches join two pieces of fabrics together. Thus, investigating the effect of a plain seam on silk fabric drape has a significant value for both clothing and textile industries.

In this study, we investigate the effect of real seams on fabric drape using Cusick's drapemeter. We study radial seams sewn on to fabric specimens. A radial seam is a plain seam sewn across a circular specimen through its center and drapes perpendicularly under the action of gravity. We discuss the seam allowance and seam number of radial seams contributing to the drape behaviour of fabrics. We use plain silk fabrics in various GSM values and present the experimental results in terms of drape coefficient, drape profile and node analysis.

2 Materials and Methods

2.1 Materials

2.1.1 Instruments

Cusick's drapemeter as per BS 5058/1973

Cusick's drapemeter measures three-dimensional fabric drape due to gravity. The experimental method involves hanging a 15 cm radius fabric specimen over a 9 cm radius supporting disc. A parallel light source inside the drape box casts a shadow from the draping specimen onto a piece of ammonia paper; the shadow pattern on the paper can be highlighted when the paper is treated with ammonia vapour and drape coefficient (DC%) can then be calculated. In cusick's modified formula, the drape coefficient is defined as the percentage of the paper weight from the drape shadow W2 to the paper weight of the full specimen W1. The formula is shown in dimensionless quantities in equation 1:

$DC\% = W2/W1 \times 100$— (1)

An industrial sewing machine Usha 8700/5590 was used for sewing seams in all the tests. Simple SSa class superimposed stitch was used as per D6193-97(2004) – Standard practice for stitches and seams.

Microtex sewing needle 100/16 was used.

GSM values (Grams/Sq meter) of all the test samples were investigated as per ASTM D3776-96 (2002)

2.1.2 Fabrics:

Plain silk apparel fabrics available in the market (Mulberry/Tasar//Muga,Eri) with varying GSM values were used for investigations.

- GSM values (Grams/Sq meter) of all the test samples were investigated as per ASTM D3776-96 (2002)
  Samples were grouped into Light,Medium and Heavy fabrics as
  Light Weight--------- -upto 60 GSM

  Medium Weight-----61 to 100 GSM

  Heavy Weight--101 GSM and above

2.1.3 Sewing thread

A polyester ply yarn of 26 Tex was used for sewing seams.

2.2 Methods

Investigations of fabric geometric parameters of experimental specimen were done, details are as shown in Table 1. All specimens were ironed at standard temperature and all were conditioned at 27°C and 65 % RH for 24 hours before testing.

Table 1. Fabric construction particulars.

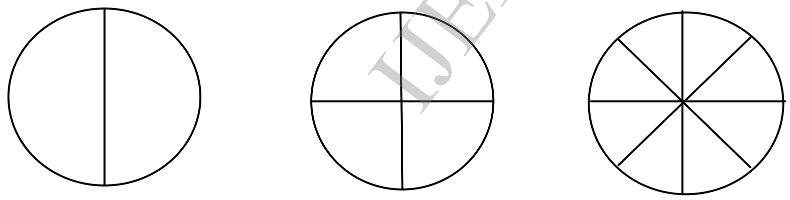
Sample No	Fabric	Construction	EPI	PPI	GSM	Thickness. mm*
S1	Mulberry,Silk(100%)	Plain	110	100	78	0.18
S2	Tasar	Plain	86	44	44	0.10
S3	Mulberry, Taffetta Pink	Plain	102	102	93	0.20
S4	Mulberry,Taffetta Yellow	Plain	136	102	84	0.16
S5	Mulberry,Soft silk white	Plain	138	124	40	0.09
S6	Mulberry,Dupion-1	Plain	116	104	86	0.17
S7	Mulberry,Crepe-1	Crepe	95	95	76	0.29
S8	Mulberry,Chiffon-W	Plain	184	162	33	0.14
S9	Mulberry,Satin-Sateen-B	Satin-sateen	126	96	150	0.40
S10	Mulberry,Raw silk	plain	128	72	40	0.16

S11	Tassar-Degummed	plain	128	92	43	0.11
S12	Mulberry,Sateen	Sateen	204	122	114	0.28
S13	Muga	Plain	104	98	56	0.15
S14	Tasar Reeled	Plain	94	64	87	0.20
S15	Mulberry,Satin-Sateen-G	Satin-sateen	115	106	138	0.25
S16	Eri	plain	85	70	59	0.13

*Thickness at pressure of 16.3 g/cm.cm

Investigation on the effect of real radial seams on fabric drape using Cusick's drapemeter was takenup as per ASTM D6193-92(2004) Standard practice for stitches and seams. A radial seam is a plain seam sewn across a circular specimen through its center and actually drapes perpendicularly under its own weight to the tangent of the pedestal as shown in Fig. 1

We designed three tests for radial seams one, two and three radial seams for circular specimens illustrated in Fig.1.The sewing method for each seam was to cut up the fabric and then sew the pieces together. A radial seam is a plain seam with the seam allowance pressed open as seen in fig.2.



(a) (b) (c)

Fig 1 -Radial seams along different directions. (a) One radial seam on the warp of a fabric. (b) Two radial seams on the warp and weft of the fabric. (c) Four radial seams on the warp, weft and 45° and 135° bias directions.

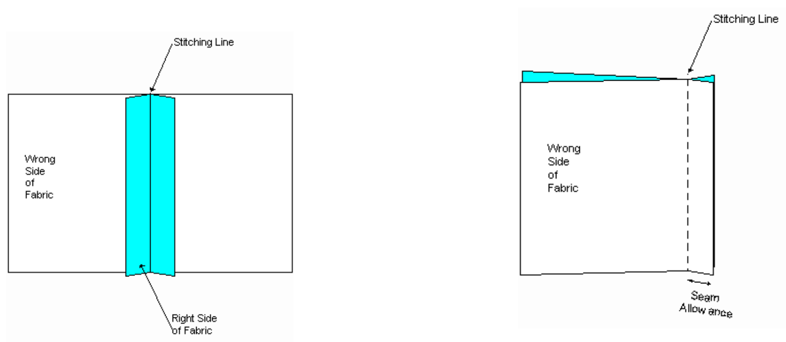


Fig 2 Plain seam with stitching line and allowance

We devised each test with seam allowances of 0 mm (no seam/control sample), 5mm and 10 mm. All sewn specimens were of 13 cm radius. All experiments used the drapemeter with a 6.5 cm radius hanging disc and a 13cm radius Cusick paper disc. There were 9 fabric samples in each lot and in all 144 samples were tested (16X9) and the results are presented in terms of drape coefficient, drape profile and node analysis.

3 Results and Discussion

3.1 Effect on Drape Coefficient(DC%) of Fabrics with One and Two Radial Seams

The drape coefficients (DC%) for fabrics with one seam are rather stable, but with two seams there is a drop in DC% especially marked for heavy fabrics, as shown in Figures 3 and 4 respectively.

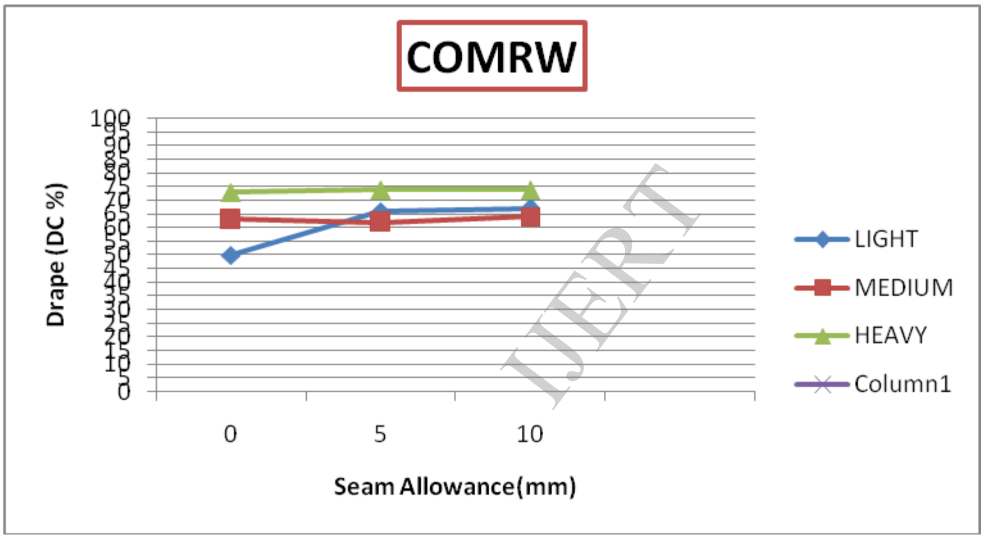


Fig 3 Combined graph for light, medium and heavy fabrics against radial warp

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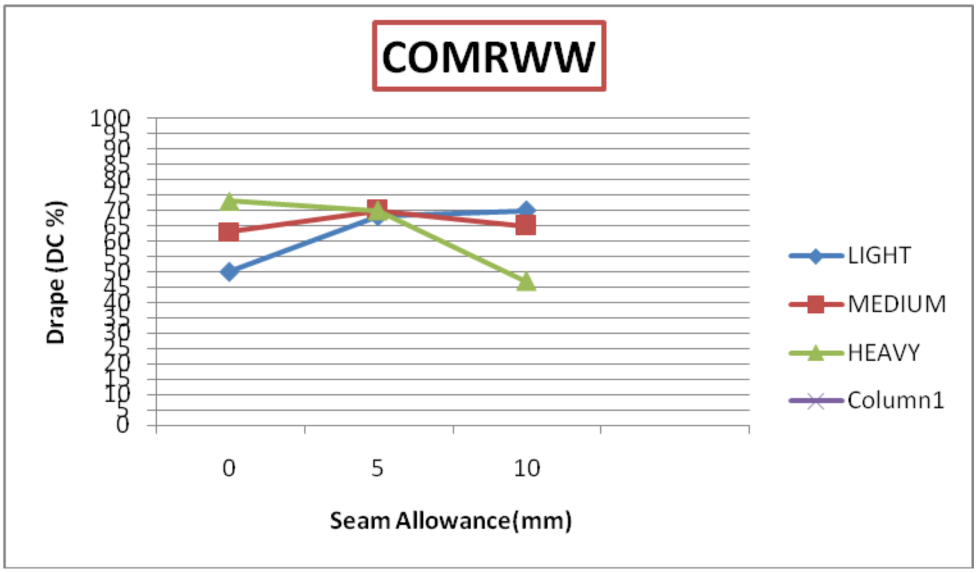


Fig 4 Combined graph for light, medium and heavy fabrics against radial warp and weft

3.2 Effect on Drape Coefficient (DC%) of Fabrics with Four Radial Seams.

Figure 5 shows that there is a slight increase in the DC% initially with additional seam. DC% is fairly stable for light and medium weight fabrics but heavy weight fabrics show marked fall in the DC% with increased seam allowance. It is seen that DC% is fairly stable with one seam but changes rapidly for two and four seams.

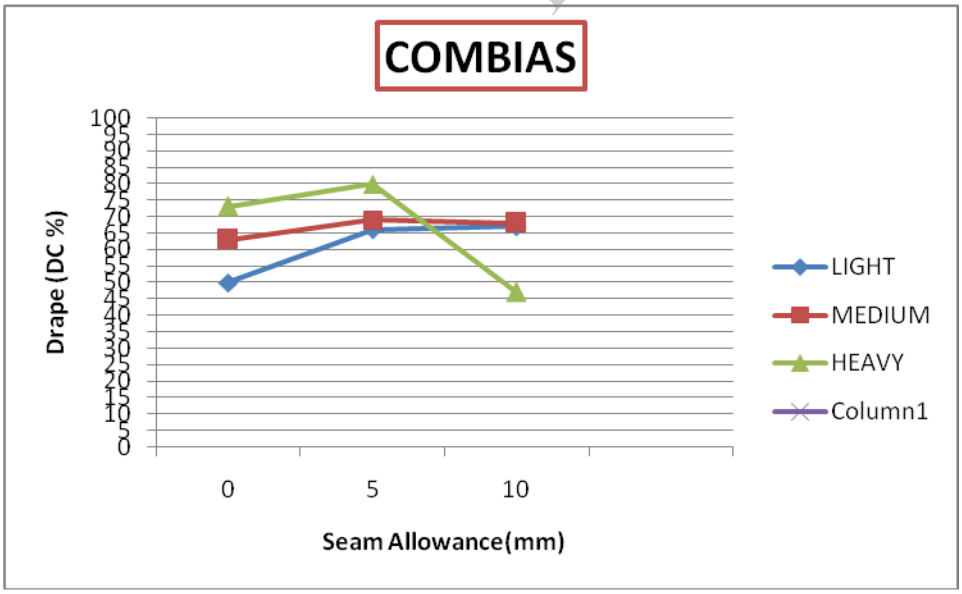


Fig 5 Combined graph for light, medium and heavy fabrics against radial bias

The DC% of the fabric with various numbers of seams can be compared from the results in Figures 3, 4 and 5. It is seen from Figure 6 that, DC% of light and medium fabrics show slight increase initially and stabilize with higher seam number whereas heavy fabrics show a initial drop in DC% with increase in seam numbers and show increase with additional seam and stabilize.

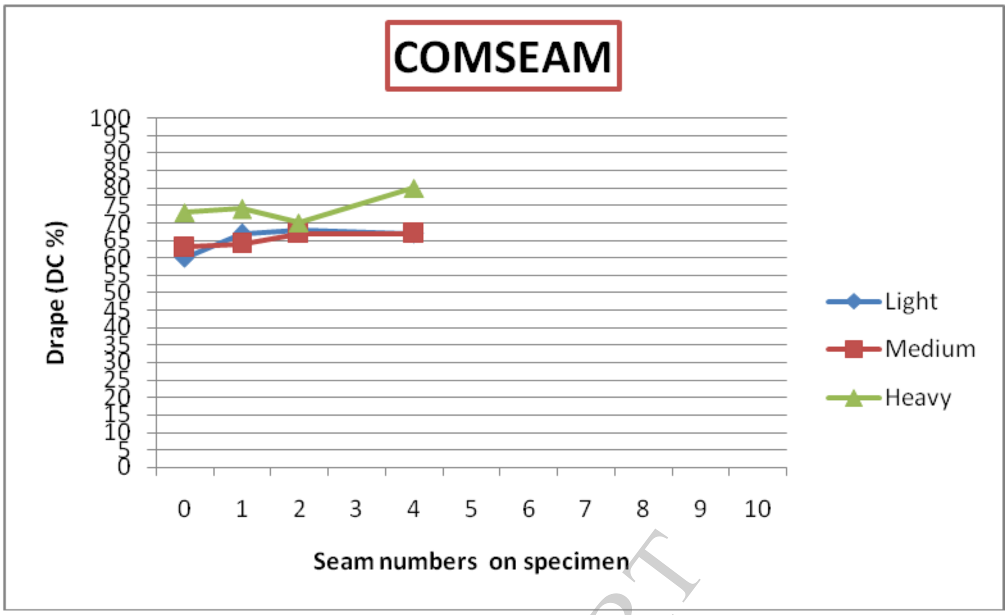


Fig 6 Drape coefficient (DC%) of various seam numbers(0,1,2 and 4)

3.3 Effect on Drape Profile of Fabrics with Radial Seams

The instability of draped fabrics can be seen on fabrics with no seams (Table 2).From the Figure 7, 8 and 9. It is clear that the drape profile shows disturbed drape with one seam and with increase in SA, it stabilizes with pronounced nodes. While with seams on both warp and weft initial profile is clear but show disturbed profile with increased SA. Medium weight fabrics for one seam show initial rearrangement in nodes. But with increase in SA there is slight orientation of nodes. But when another seam is introduced there is a clear cut arrangement of nodes along the seams for both seam allowances. Heavy weight fabrics with an addition of a seam show not much rearrangement but with increased SA there is slight displacement in nodes. But with warp and weft direction seams there is a clear cut arrangement of nodes along warp weft directions.

With four seams light weight fabrics show increased nodes compared to two seams, but profile remains almost same as that of two seams. Increase in SA for four seams increases the clear orientation of nodes along the seam lines. Profile of the medium fabrics with four seams remains same as that of two seams. But number of nodes increase appreciably compared to zero seam. Heavy fabrics show not much arrangement of nodes. But when two seams are sewn there is clear orientation of nodes along warp and weft directions. But with introduction of fourth seam number of nodes decrease with reduction in node, and sample is directionally oriented as seen in above figures.

Table 2 (a) Effect of One radial seam along the warp direction on number of nodes.

SA in mm	Light weight fabrics (Nodes)	Medium weight fabrics (Nodes)	Heavy weight fabrics (Nodes)
0	6	6	6
5	5	5	6
10	4	6	6

Table 2 (b) Effect of Two radial seams along the warp and weft directions on number of nodes

SA in mm	Light weight fabrics (Nodes)	Medium weight fabrics (Nodes)	Heavy weight fabrics (Nodes)
0	6	6	6
5	4	5	6
10	4	5	6

Table 2 (c) Effect of Four radial seams along the warp, weft and two bias directions on number of nodes.

SA in mm	Light weight fabrics (Nodes)	Medium weight fabrics (Nodes)	Heavy weight fabrics (Nodes)
0	6	6	6
5	7	7	7
10	6	6	7

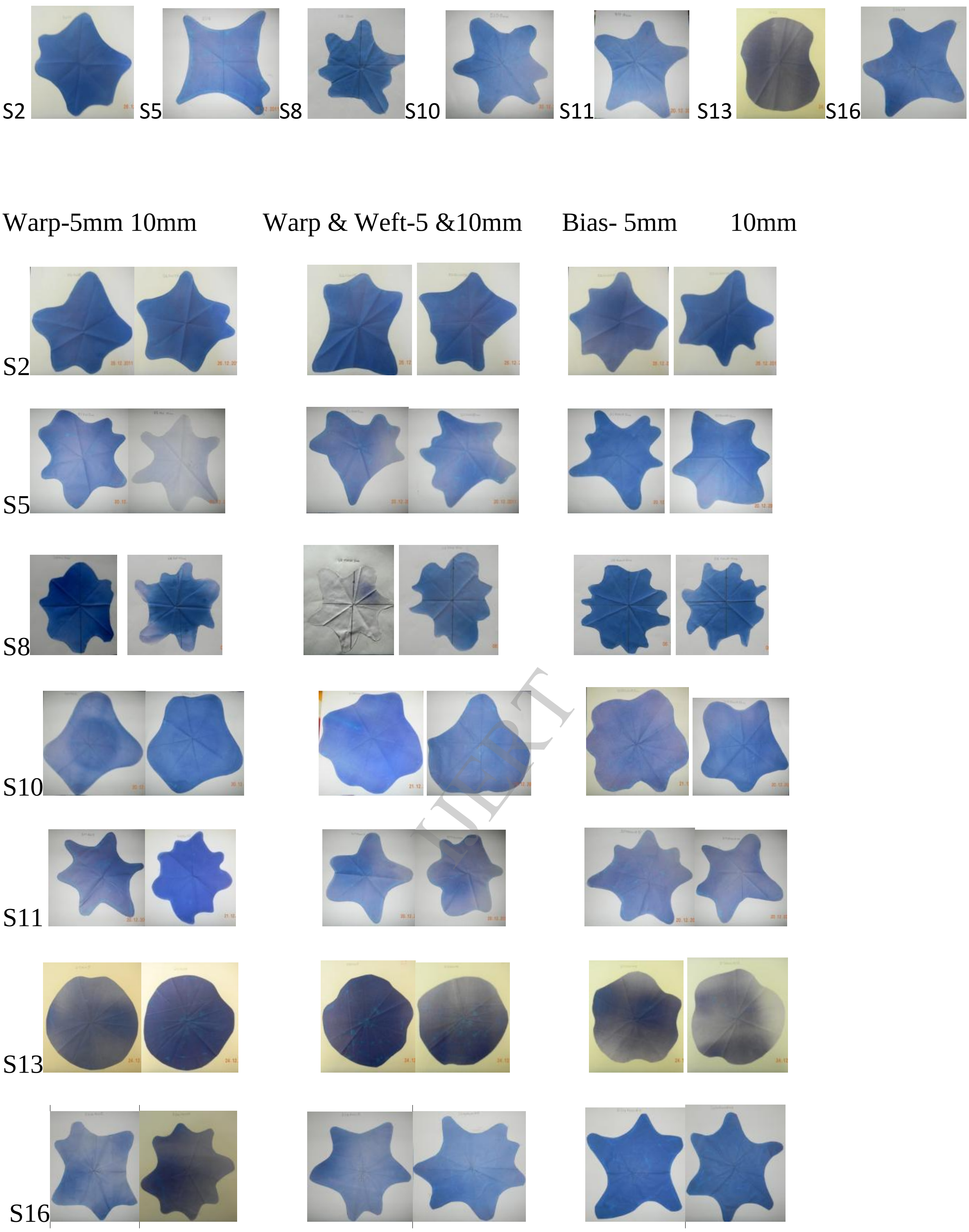


FIGURE- 7. Zero seam Drape profiles of Light weight fabrics' Vs 1,2 and 4 seam profiles

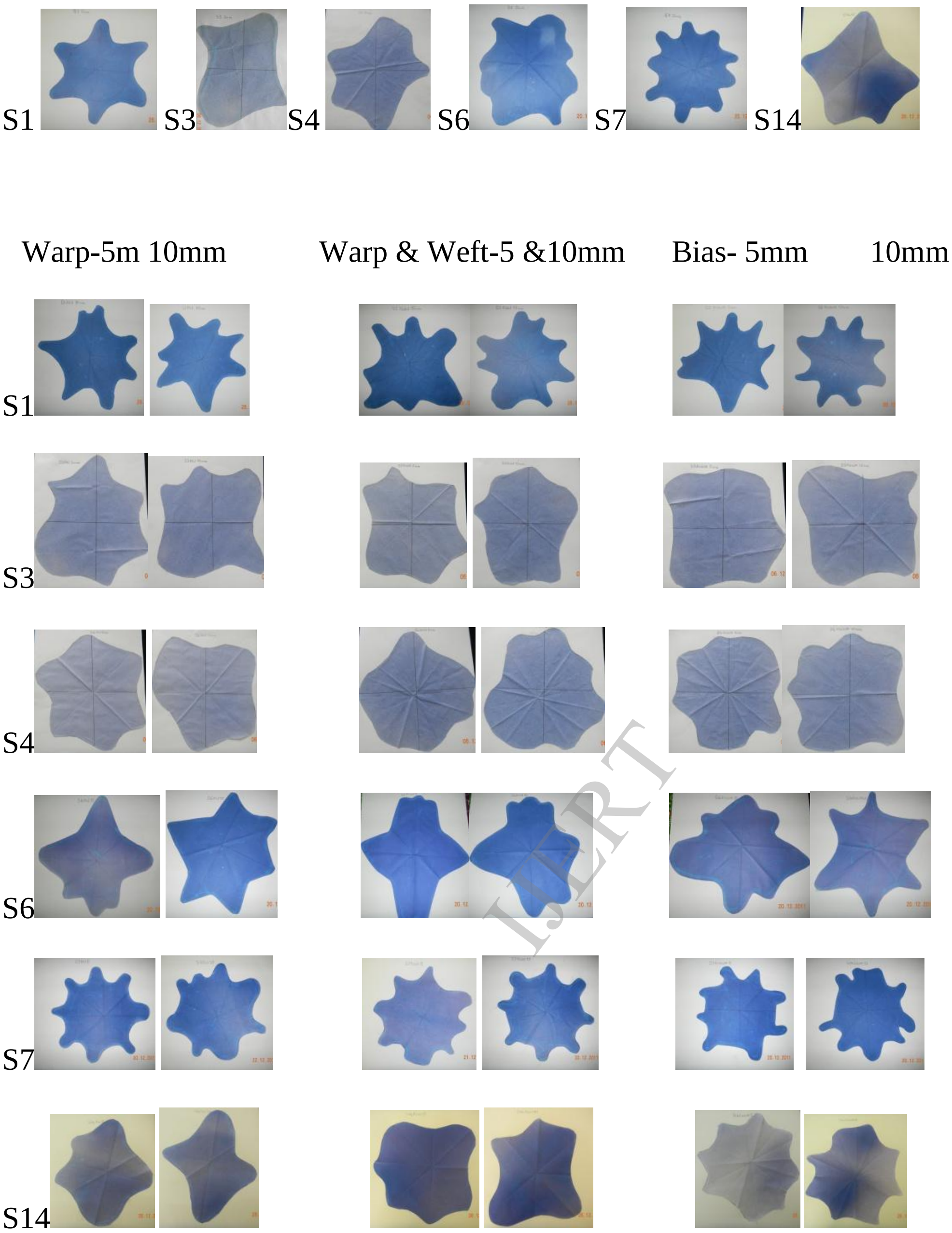
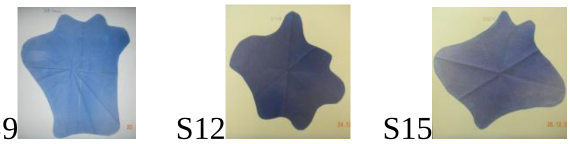


FIGURE 8. Zero seam Drape profiles of Medium weight fabrics' Vs 1,2 and 4 seam profiles

S9 S12 S15



Warp-5mm 10mm Warp & Weft-5 &10mm Bias- 5mm 10mm

S9

S12

S15

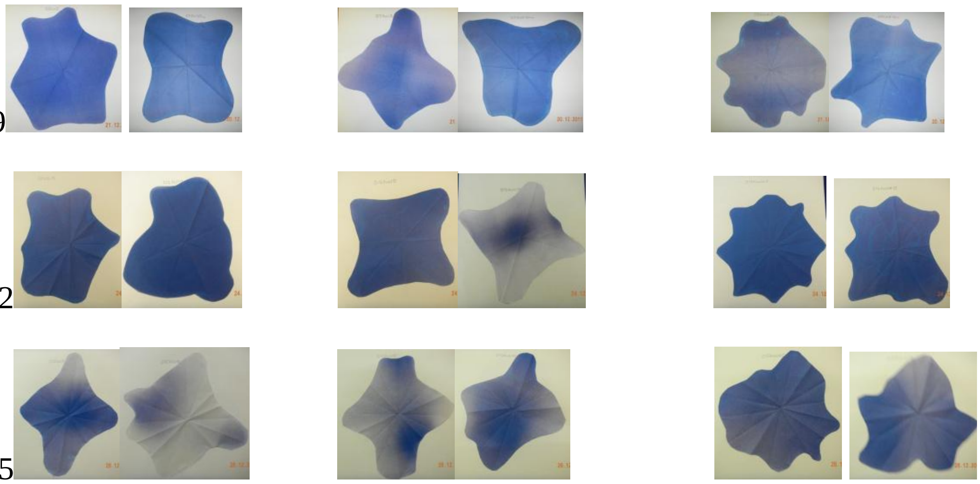


FIGURE 9. Zero seam Drape profiles of Heavy weight fabrics Vs Drape of 1,2 and 4 seam profiles

4 Conclusion

The investigations involved change in drape behaviour of silk fabrics with respect to change in seam number and allowance of radial seams.

We have found that drape coefficient for fabrics with one seam are rather stable. But with two seams there is a drop in DC% especially marked for heavy fabrics. There is a slight increase in DC% initially with additional seams. DC% is fairly stable for light and medium weight fabrics, but heavy weight fabrics show clear trends marked by fall in DC% with increased seam allowance. Generally DC% is stable with one seam but changes rapidly for two and four seams.

The drape profile of an unseamed fabric is not stable, and node numbers vary in every drape test. Drape profile show irregular node orientations with one seam and with increase in seam allowance it stabilizes with pronounced nodes.

References

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[2] Cusick. G.E. The measurement of fabric drape, J.Textile Inst. 59(6) (1968) 253