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Node analysis of digital drapemeter

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A digital drapemeter has been designed and developed for the node analysis of the varying commercial fabrics. The image analysis technique is used for the acquisition of the images and processed through the software. The separate graphical user interface is developed to display the values of DC% of the fabrics. The result confirms that there is a good and positive correlation between the newly designed drapemeter and the commercially available traditional drapemeter. Negative correlation has been found between the numbers of nodes and the drape coefficient of fabrics.

Keywords: Aesthetic property, Digital drapemeter, Drape, Droops, Fabric node, Silhouette

Measurement of the fabric drape was first carried out in 1950 using a drape coefficient by the development of drapemeter, based on the principle as explained by Pierce[1]. Further, for measurement of drape parameters, methods were proposed by Chu *et al*[2]. Recent measurement technique includes a circular fabric which is sandwiched between the two discs of 12.5 cm diameter. An actinic source of light is placed directly above the centre of the discs with suitable attachment to give a parallel beam of light. A sheet of ammonia paper is placed horizontally below the draped specimen. A metal template of 25 cm diameter is used to cut and hold the sample centrally[3]. When the light falls on the specimen, the part of draped sample with ammonia is traced by weighing the traced ammonia paper and the drape coefficient is calculated using the following relationship:

$$\text{Drape coefficient} = \frac{\text{Area of draped sample}}{\text{Area of sample template}} \times 100$$

Since the present conventional technique is based on tracing, cutting and weighing of the image of draped fabric, it is the subjective and laborious too. While in tracing, cutting and weighing of the ammonia paper, subjective variation will be there and it is more time-consuming.

Thus, the present technique of drape measurement limits the use of drape in quality assurance. Hence, it was thought that the new digital drapemeter based on image analysis method will be more useful to overcome the problems in measuring the drape coefficient. Also, the fabric node analysis by the computational methods will be much easier for the researcher of the textile and apparel industries.

In this study, an instrument has been developed for the measurement of drape coefficient of the fabrics. A planar projection of the contour of the draped specimen is recorded by the camera. The drape pattern obtained is processed through the software for the image analysis. The drape coefficient is calculated as the ratio of the projected area of the draped specimen to its theoretical maximum.

Experimental

The draped image was acquired by using the instrument as shown in Fig. 1, and for the image processing, computational software was used. The detailed process of image acquisition is shown in Fig. 2. During image capturing and digitization, noise can be observed in the image to some extent due to external causes, which may result in errors in the

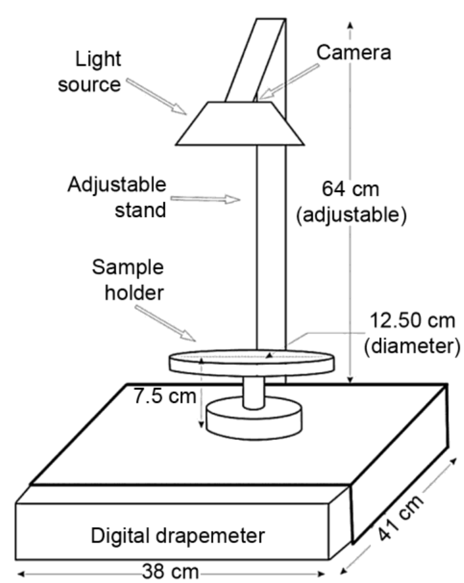

Fig. 1 — Schematic diagram of digital drapemeter

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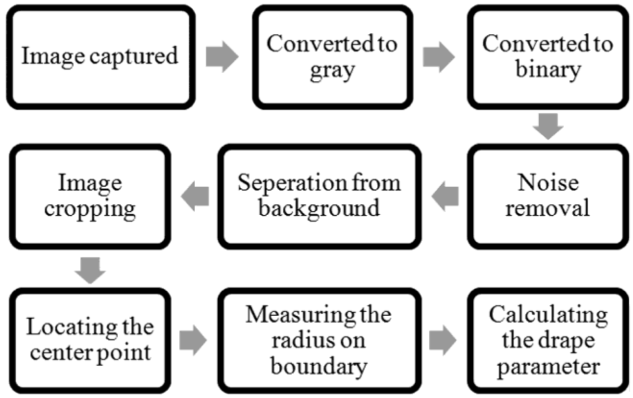

Fig. 2 — Image acquisition process with software

Table 1 — Number of nodes of different bottom wear fabrics

Fabric	Code	Drape coefficient (New drapemeter)	No. of nodes
Linen	L1	75.66	5
	L2	76.67	4
	L3	81.85	4
Cotton	C1	74.63	5
	C2	80.01	5
	C3	82.39	4
Polyester- cotton	PC1	62.39	6
	PC2	63.21	6
	PC3	66.36	4
Denim	D1	77.31	4
	D2	82.86	3
	D3	88.52	2
Corduroy	CY1	80.56	4
	CY2	85.74	3
	CY3	95.39	3

image analysis. Therefore, median filtering was applied to minimize noise in the image histogram and equalization was performed to enhance image contrast for easier recognitions or demarcation of specific regions.

Different fabrics, as shown in Table 1, has been procured commercially. Structured woven fabrics are used for the bottom wear fabric, considering plain and twill weaves with various contents such as cotton, linen and polyester.

Results and Discussion

The results of the node analysis of different fabrics and their drape coefficient values are given in Table 1. The effect of fabric nodes on drapability of fabrics has been studied, however, the significance of number of nodes has not been ascertained yet. It would appear logical that it is related to some aesthetic criterion which may be deduced by correlation with respective evaluation. A discussion of the applied mechanics of the drapemeter pattern by Hamburger *et al.*[4] leads them to conclude that number of nodes is a function of the buckling length and for textile fabrics, this is virtually constant. The number of nodes formation also depends on the time[5].

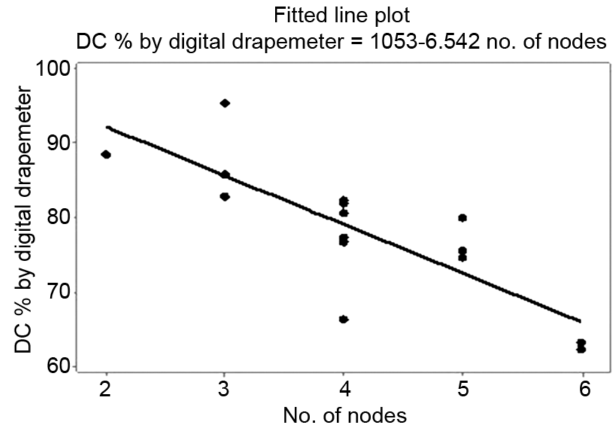

Fig 3 — Correlation between number of nodes and drape coefficient

By analyzing the shapes of the nodes formed through the draping, it can be confirmed that the heavier fabrics form fewer nodes as compared to light weight fabrics. No specific shapes are formed with the drape image. The light weight fabrics have more buckling effect and hence they show more number of nodes in comparison with the medium and heavy weight fabrics.

Also, the structure of the heavy weight fabrics has more resistance towards buckling and hence they exhibit less number of nodes. As shown in Fig. 3, it is found that there is no correlation between the number of nodes and drape coefficient of different fabrics. This is related to the flexibility of the textile material affected largely by its own weight. As the weight of the fabrics increases the force to initiate buckling is also increased.

The study on correlation coefficient is carried out for the drape from the newly developed digital drapemeter and commonly used traditional drapemeter. The drape coefficient is highly and positively correlated, as correlation coefficient is 0.861 (P=0.99). These results follow the trends of findings of Kenkare and May-Plumlee[6]. Also, there is no significant difference found between the drape coefficient values at the 5 % level of significance (LoS).

The digital images acquired can be more beneficial for the study of fabric behaviour, considering that the number of nodes and its nodes profile can be analyzed. There is no significant difference found between the drape coefficient values of developed drapemeter and commonly used conventional drapemeter. it is confirmed that there is no direct relation between the number of nodes and the drape coefficient, but the fabric can be analyzed subjectively for the nodes formation. A negative correlation is observed between the number of nodes and drape coefficient.

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