TT - II

Module 5:-

* Shearing Properties of fabric :-

- Shear property is one of important properties that determine drapability & formability of fabrics Therefore, the characterization system of the handle properties of fabrics & yarns have been developed & is analyzed to know whether the CHS-FY system is capable of characterizing shearing properti

- The shearing characteristics of fabrics have to be considered in designing air bags, space suits & inflatable sheltes. which are usually bi-axial & multi-axial stress. fields and in which the order of stress is much higher than in the garment & use.

Methods to determine the shearing characteristics

1. Behre's method
2. Spivak's method
3. Casick's method
4. Treloar's method
5. Culpin
6. Hamilton & Potter's method.
7. TNO method
8. Prevorsek's method.

Shear test :-

Principle: The fabric is clamped at one end to a top clamp. which rotates at uniform speed to the other end a std load is applied

Procedure :-

- The instrument consists of top clamp holder with protractor which rotates at std speed.
- The cloth sample is mounted using the mounting device, in the top and bottom clamps under std tension, using the marked with thread line & bottom.

- clamp centre mark, the study of shear stress & shear strain is conducted.
- The cloth sample in warp or weft direction is cut for a size of 15cm x 10cm. This sample is ironed to remove any creases.
- The mounting plate with handle is placed over the mounting block. The clamps are fixed on the mounting plate.
- The two clamps are separated by a distance of 10cms. The cloth sample is placed over the serration of the clamps.

The top clamp is first tightened, to the other end of the fabric, a 200gm load is attached.

Now the fabric is under a std tension of 200gms. Now the bottom clamp is tightened.

- The std load is removed & remaining fabric length is now cut.
- The mounting plate is removed from the block along with the cloth sample clamped b/w top & bottom clamps & the top clamp is fitted by screws, to the rotating top clamp holder. The mounting plate is removed from the clamps.

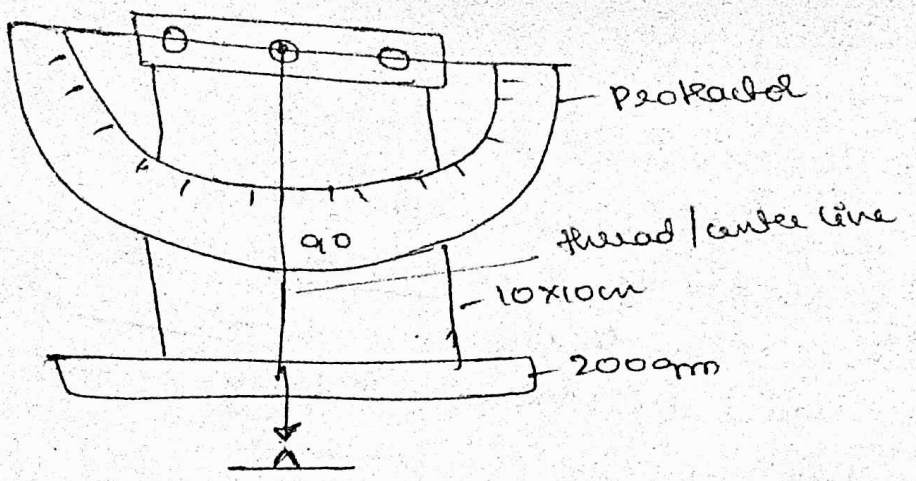
- Now the cloth sample of 10x10 cm b/w the top & bottom clamps is hanging vertically with a load of 200gm, the instrument is levelled using the levelling screws, so that the indicator on thread line coincides with the fixed point.

The protractor is operated so that the thread line coincides with 90°.

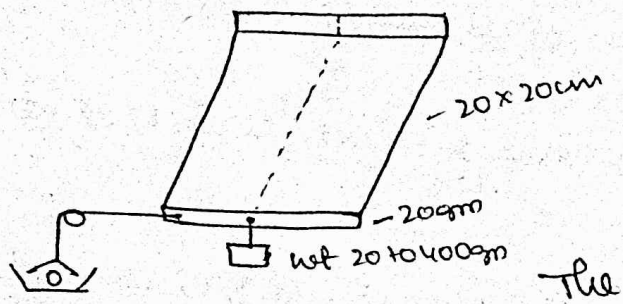
- The top clamp is now rotated for different angles of α the corresponding shear strain angle ϕ with reference to the bottom clamp centre line are noted.

The shear strain is directly by $\tan\phi$. The shear stress is given by shearing force per unit sample width.

$$\tau = \frac{W \sin(\alpha - \phi)}{a \cos\phi} \text{ gm.f/cm}$$



Trelease's Method:-



- Trelease has employed a simple method & it consist of a rigidly mounted top clamp AB, an a highter lower clamp DE, each 8" in length.

The lower clamp consists of two strips 3/8" wide & 1/10" thick, held together by means of brass screws. Its total weight was 20gm.

- Holes at C, D & E enables threads to be attached for the application of the horizontal & vertical loads.

- Means were provided for gripping the horizontal connecting thread. So as load was being changed, measurements of horizontal movements by means of a vernier microscope provided. Also it enables simultaneous ~~provided, also it enables~~ measurements of the tilt of the lower clamp to be made.

- Two shapes of specimen were used.

The first was a square of side 20 cm & the second rectangle of the same width but of length 22cm. On account of the lightness of the lower clamp a range of normal loads (20-400gm) could conveniently be studied.

- Tensile ~~loads~~ stresses ranging from 1 to 20gm/cm were applied simultaneously in the direction normal to the direction of shearing & observations made also of the incidence of wrinkling of the specimen & of the changes in its

length accompanying the shearing.

* Fabric fatigue :-

- A fabric is clamped b/w two jaws kept horizontally. One jaw is capable of making reciprocating sideward motion at a speed of 5 Hz) the other jaw is loaded to give tension to the fabric. Hence the shearing of fabric is done under known tension.

- The instrument consist of 2 clamps to clamp a fabric specimen of 200mm width & 50mm gauge length.

One clamp reciprocate & the other clamp is tensioned upto the maximum of 10kg.

An autostop counter is provided to set required no of cycles of shearing operation.

- A fabric specimen of 200mm x 200mm is cut & clamped. keeping 50mm gauge length b/w the clamps. the reqd no of cycles of operation is set in the autostop counter.

The required load 5-10kg is applied to the fabric specimen.

- Now the M/c is switched on. when the M/c stops, the fabric specimen is removed from the clamp & tested for mechanical properties.

The high stress & low stress mechanical properties of fabric can be compared b/fore & after fatigue operation.

Course length test :-

- This is a measure of loop length & tightness factor in knitted fabrics. the waviness in yarns, formed due to knitting is removed under standard tension & the straightened length of the yarn is measured.

- The instrument used consist of a rectangular board containing a series of freely revolving pulleys,

... of distance markers fitted with clamps & a fixed clamp on one side. This instrument is of wall mounting type.

- The yarn is unravelled from the fabric & its length is estimated with the instrument. A starting point on the board to this starting point is selected with a distance marker slightly less than the estimated length of the course.

- One end of the yarn is clamped to this starting point. the free end of the yarn is then taken in the direction shown by the arrow at the chosen point & over the tensioning pulley until it hangs down in front of the scale.

- The tension nut is attached to the free end of the yarn. this will remove kinks from the yarn without causing yarn to extend.

The reading on the scale is noted & this value is added to the distance marker reading at the starting point. This is the course length of the knitted fabric.

Loop length :- It is the length of yarn per knitted loop which is derived from measurement of length of yarn per knitted course.

$$\text{loop length} = l = \frac{\text{course length}}{\text{No of needles or loops.}}$$

$$\text{tightness factor} = \sqrt{\frac{\text{Tex}}{2}}$$

Fabric hand :-

* Bending properties :
  - Elastic flexural rigidity
  - Bending recovery
  - multi-curvature bending rigidity.
  - Single curvature bending rigidity.

Draping properties:- Drape coefficient.

Shearing properties:- Shearing stress
- Initial shearing resistance
- Initial —"— modules
- Shearing recovery

Tensile properties:- Extensibility
Initial youngs modulus
Tensile recovery

Compressional properties:- Thickness
compressibility
Hardness
compressional recovery

Ksan

Frictional properties:- coefficient of static friction
co—"— kinetic friction

Area Density:- wt per unit area.

Bending of fabric:-

- Friction is the resistance to relative movement b/w two bodies in contact with each other.

Because fabrics are woven from yarns composed of a large no of fibres twisted together, it is understandable that fibre to fibre friction influences most mechanical properties of fabrics such as tensile, shear & bending behaviour.

During bending of fabric close observation of individual fibres through a microscope reveals a large degree of fibre movement. Each individual fibre is bent & shifted longitudinally against other fibres.

- Since inter-fibre friction can either prevent relative motion b/w fibres or produce a restraining force of such movement occurs, interfibre friction plays an important role in the bending

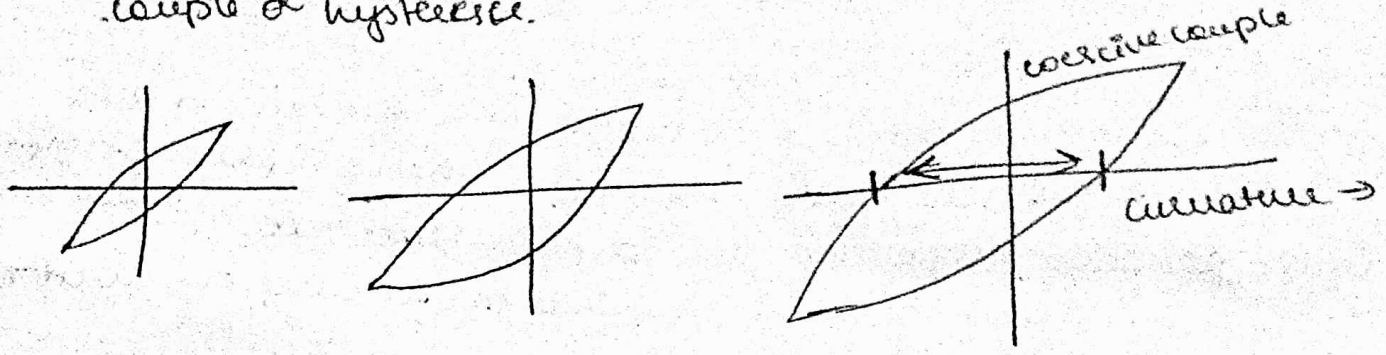
- multiple influences affect end-use characteristic of fabric such as handle drape, crease recovery, wrinkle resistance & tailorability.

Important bending properties can be measured by the cyclic bending of a fabric sample to obtain a bending hysteresis curve.

Example of such curves are shown in fig, which consist of a series of bending hysteresis curves obtained by the cyclic bending of a fabric sample at different maximum curvatures of bending.

Such curves characterize two important bending properties of fabric:

The slope of the linear region is the bending or flexural rigidity. & the width of the hysteresis loop at zero curvature is the coercive couple or hysteresis.



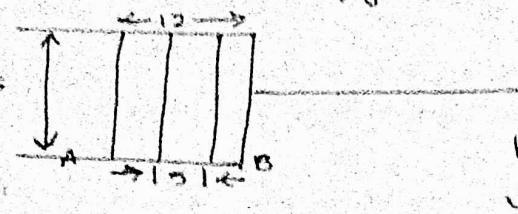
Cyclic Bending tester

It is applicable in the development of yarns & fabric of different constructions & in the study of the effect of different finishes & treatments the textile materials are subjected

- This instrument consists of a disc containing a specimen clamp rotating at std speed.
- This disc contains of radius of curvature scale for the std. 5mm gauge length test.

A couple scale is fitted around this sample specimen with pointer at one end is clamped in the specimen clamp. the study of couple for different radius of curvature can be carried out with reference to the pointer.

The sample is cut of std size 25mm×12mm. leaving in the middle rest of the portions are covered with cellotape tape as shown in the fig.



To the end B a pointer is attached with cellotape. then, the end B can be clamped in the specimen clamp with one x coinciding the clamp edge.

The pointer is selected as follows:
The micrometer scale is switched on & the zero of this scale is made to coincide with 1.0 of the couple scale.

The sample is clamped & the pointer reading is noted along the couple scale. This should be around 0.4 to 0.6. If the pointer shows lower & higher reading than this, lighter & heavier pointers can be used respectively, to arrive at this reading.

Operation:

The micrometer scale is switched on & the zero of this scale is made to coincide with zero couple. the sample is clamped along with pointer. the pointer should now read zero.

The micrometer scale is switched on to any one direction the reading is taken as given below.

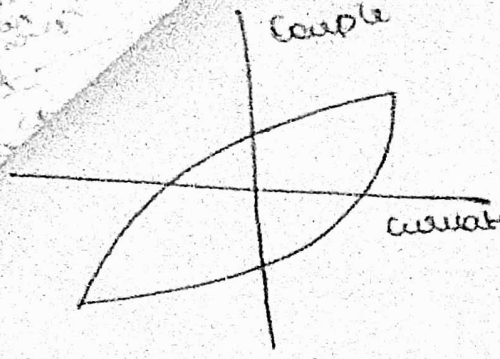
When the pointer coincides with $0.25cm^{-1}$ of micrometer scale, note the corresponding couple scale reading ($\sin\theta$) with reference to the pointer.

Similarly the second $\sin\theta$ reading is taken when the pointer coincides with $0.5cm^{-1}$ radius of curvature. reading can be taken in this direction upto $3cm^{-1}$, the $\sin\theta$ readings are taken.

Again changing the direction of micrometer scale, the couple scale readings from $2.75cm^{-1}$ to 0. is taken. keeping the micrometer scale rotating in the same direction for radius of curvatures.

From 0 to $3cm^{-1}$, the $\sin\theta$ readings are taken. thus a complete cycle is obtained.

Couple Vs curvature is plotted to obtain the bending hysteresis diagram as shown.



the couple calculated as follows:-

$$\text{Couple of Bending moment} = \frac{Wg(L+0.35)\sin\theta}{2.5} \text{ dyn.cm/cm.}$$

where, W - wt of points in gm

g - Acceleration due to gravity

L - Distance b/w sample tip & centre of the gravity of pointer

2.5 - is the width of sample in cm

unit: gdyn cm/cm.

* Assessment of fabric quality for garment making:-

Quality:- Systematic approach.

Eight dimension of quality:-

- performance
- Features
- Reliability
- conformance
- durability
- Serviceability
- aesthetic
- Perceived quality.

Garment must be free from:-

1. free from defect: Stains, nkl defect, open seams, loose hanging threads, misaligned threads, button holes, defective zippers etc.
2. Must fit properly for the labelled size
3. perform satisfactorily on normal use.

Fabric inspection:-

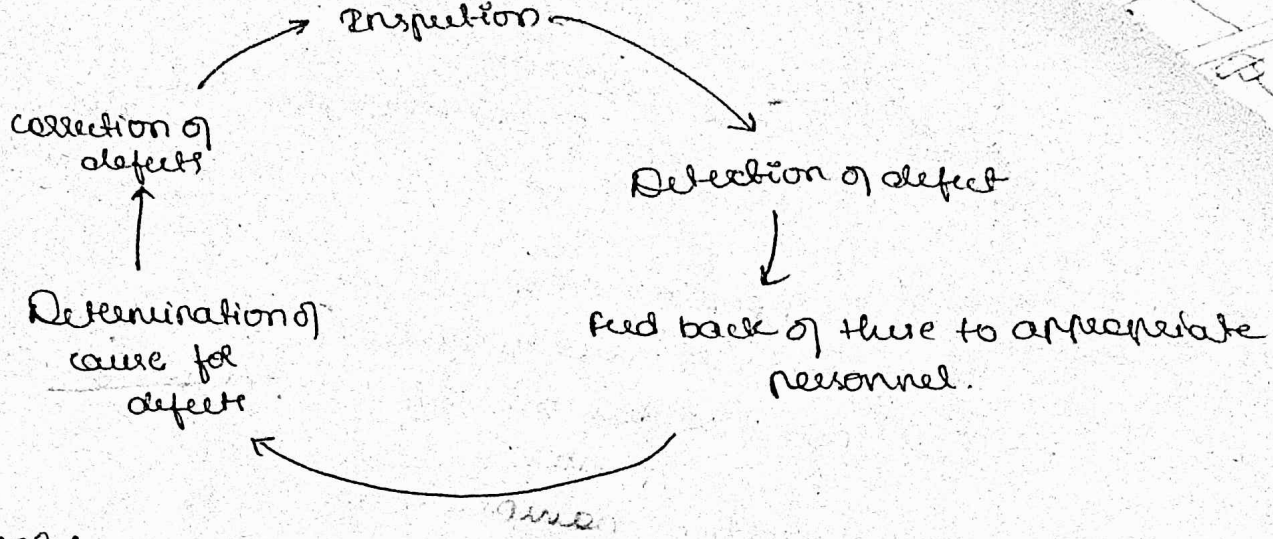
Visual examination

Partially finished garment

Fully finished garment

See whether requirement is met or not

Principle :- Inspection loop.



- 4 point system
- 15 point system
- Granville system

4 point system :-

length of defect	point allotted
upto 3"	1
3" – 6"	2
6 – 9"	3
9"	4
Hole & openings 1"	2
Over 1"	4.

10 point system :-

warp defects :	Points
1"	1
1–5"	3
5–16"	5
16–36"	10

weft :	
1"	1
1–5"	3
5" – ½ width	5
½ – full width	10.

...cle system:-

...gth of defect	pts
upto 9"	1
9 – 18"	2
18 – 27"	3
27 – 36"	4.

$$\text{Max No pt/linear yd} = \frac{\text{fabric width in inch}}{9}$$

Ex: width of fabric $= \frac{48"}{9} = 5.5 \simeq 6$

Sewing thread characteristics:-

1. construction: linear density, ply, twist, twist balance, strength elongation.
2. Sewability: 3pkg from lot
   - 100yd sewing at normal condition
3. Imperfections: finish, color, pkg, density, winding, yardage etc are considered.

Zippers:-

- Dimensions
- Top & bottom should be sewed
- color uniformity
- No winkling, puckering
- washed, dry cleaning etc
- Force taken to pull out zipper
- pull tap fixed firmly
- snag-free movement.

* AQL – Acceptable quality level.

Max defective that for the purpose of sampling inspection can be considered satisfactory as a process avg.

AQL : Ex 4 (usually 2.5, 4, 6.5 & 10)

Ex: Batch size : 600

AQL = 4 ↑ Mean lot of batch accepted will contain >4 ↑ defective

lot of batch size	SPI			General		
	S_1	S_2	S_3	I	II	III
2 - 8	A	A	A	A	A	B
9 - 15						
501 - 1200	C	C	E	G	J	K
5000 - over	D	E	H	N	Q	R

$\bar{c} = \frac{\Sigma d}{n}$

Sample size code letters	1	1.5	2.5	4	6.5 to
	Ac Rc			Ac Rc	

A 1
B
C
D
E
F
G
H
I
J (80)

7 8

If no of defective is 7 accept
8 reject