# Anew Technique for Continuous Measurement of the Cloth Fell Movement and Some of its Applications

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## Abstract:

This paper describes A new technique for the continuous measurement of the cloth fell movement. The retention (retaining, R) and the expulsion (expelling, E) displacements of the cloth fell are precisely measured. This technique is simple and straight forward. It yields a continuous record of cloth fell movement for many machine cycles. This technique is applied to picanol loom and could be applied to any loom .The effect of loom speed and weft density on both forward (R) and backward (E) displacements of the cloth fell has been determined.

**الملخص**:

هذه الورقة توصف تقنية جديدة لقياس مستمر لحركة نقطة ضم القماش. المسافة التى تتحركها نقطة ضم القماش فى اتجاه الضم (R) و كذلك المسافة التى تتحركها هذه النقطة فى اتجاه الرجوع (E) تم قياسها بدقة بواسطة هذه التقنية. هذه التقنية بسيطة و مباشرة و انتجت سجل متواصل لحركة نقطة ضم القماش لعدة دورات للماكينة. تمت تجربة هذه التقنية فى ماكينة نسيج بيكانول و بالتالى يمكن تجربتها فى اى ماكينة نسيج. تمت دراسة اثر سرعة الماكينة و كذلك اثر كثافة القماش على حركة نقطة ضم القماش فى هذه الورقة.

## 1- Introduction:

Previous researchers used a microscope fixed on a rigid frame to measure the displacement of the fell of the fabric .Their methods were not convenient and accurate. Greenwood and Vaughan [1] measured the position of the fell by using an optical method where an image of the cloth fell was projected upon a wall.

Their method did not give a continuous image due to the movement of the reed and the race board that obstructed the source of the light to the illuminated area.

A continuous measurement of the fell movement is very essential for studying the behavior of the fell against some technological parameters.

## 2- Materials & Methods:

Figure (1) shows the experimental arrangement for continuous measurement of the fell movement.

A 3-inch stroke transducer was used with an AC-LVDT (Linear Variable Differential Transformer) conditioner. The transducer (T) was fixed in a horizontal position, approximately 1cm above and parallel to the fabric and attached to a heavy steel stand (S). It must also be set perpendicular to the cloth fell as shown in Figure (1). The small pin (P) was inserted in the fabric just before the cloth fell (i.e., last inserted pick). The output of the transducer was directed to an oscilloscope (Nicolet) which has the facility of increasing and decreasing the number of machine cycles that could be shown on its screen. An XY recorder (R) was connected to the oscilloscope in order to show continuous records of the cloth fell displacement.

The whole arrangement was connected to a noise suppression transformer (M) to eliminate the noise caused by loom vibrations. The displacement of the last- but- one pick towards the front of the loom was designated (R) and the subsequent recovery displacement of the fabric towards the back of the loom was designated (E).

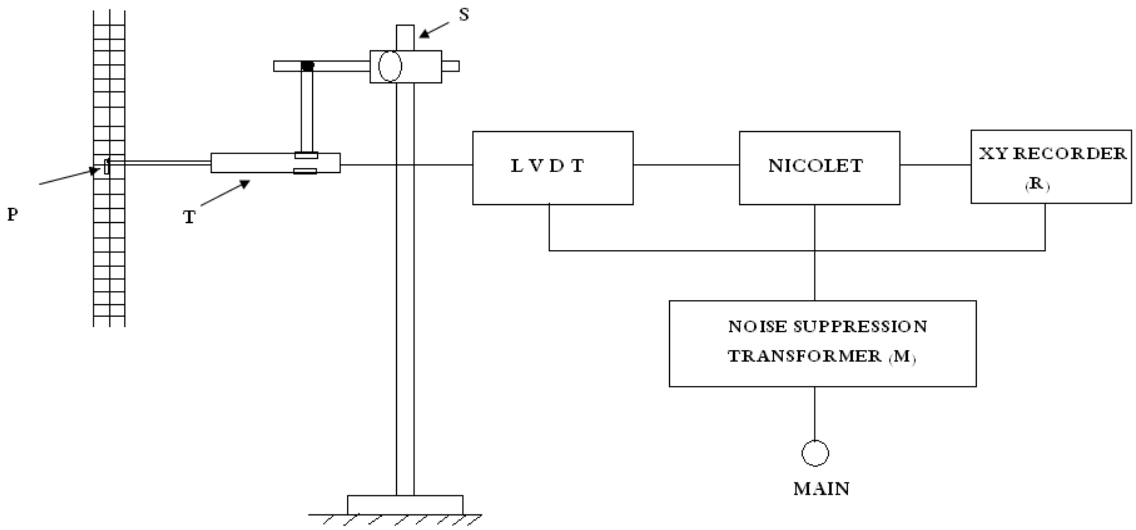


**Fig. (1):** Experimental Arrangement for the Continuous Measurement of the Fell Movement.

## 3- Results and Discussion:-

The effect of loom speed on the forward (R) and backward (E) displacements of cloth fell was studied. Also the effect of weft density of the fabric on both forward (R) and backward (E) displacements was determined.

### 3.1 The Effect of loom speed on cloth fell movement:

The arrangement shown on Figure (1) was used for measuring the forward (R) and backward (E) displacements of the cloth fell at 6 various loom speeds as given in Table (1). Two traces were produced for the loom running at 199 and 208 revs/min and were shown in Figures (1.A) and (1.B) respectively. The displacements R and E were recorded starting from the first pick inserted after the loom being started from back dead centre position. It should be noted that the first peak was ignored as it was considered to be not representative of the beating-up action at full loom speed. It was found that both fell displacements R and E increased with loom speed as shown in Table (1) and plotted in Figure (2).

It can be seen that the difference (A) between R and E which represent the actual displacement is constant over the whole range of loom speeds used. This difference between R and E represented the space in which the weft yarn was laid.

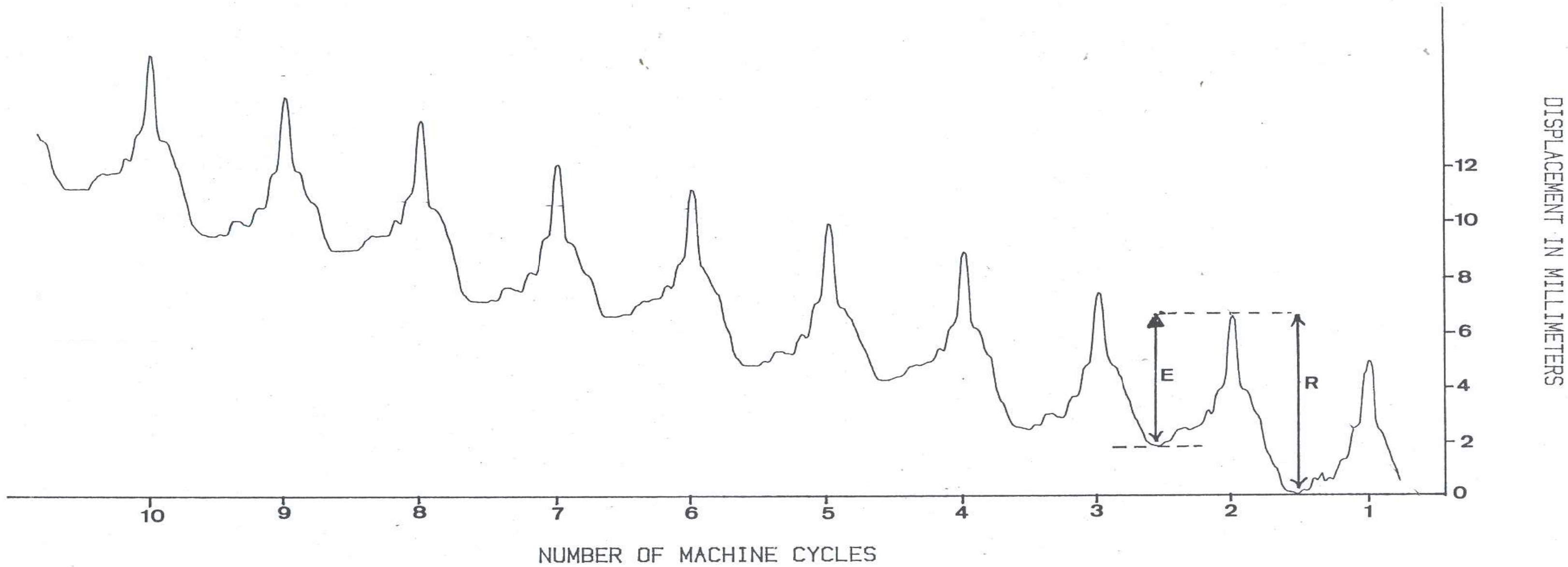


**Fig. (1.A): The Forward (R) and Backward (E) Displacements of the Fell of the Fabric At the Speed of 199 (r.p.m)**

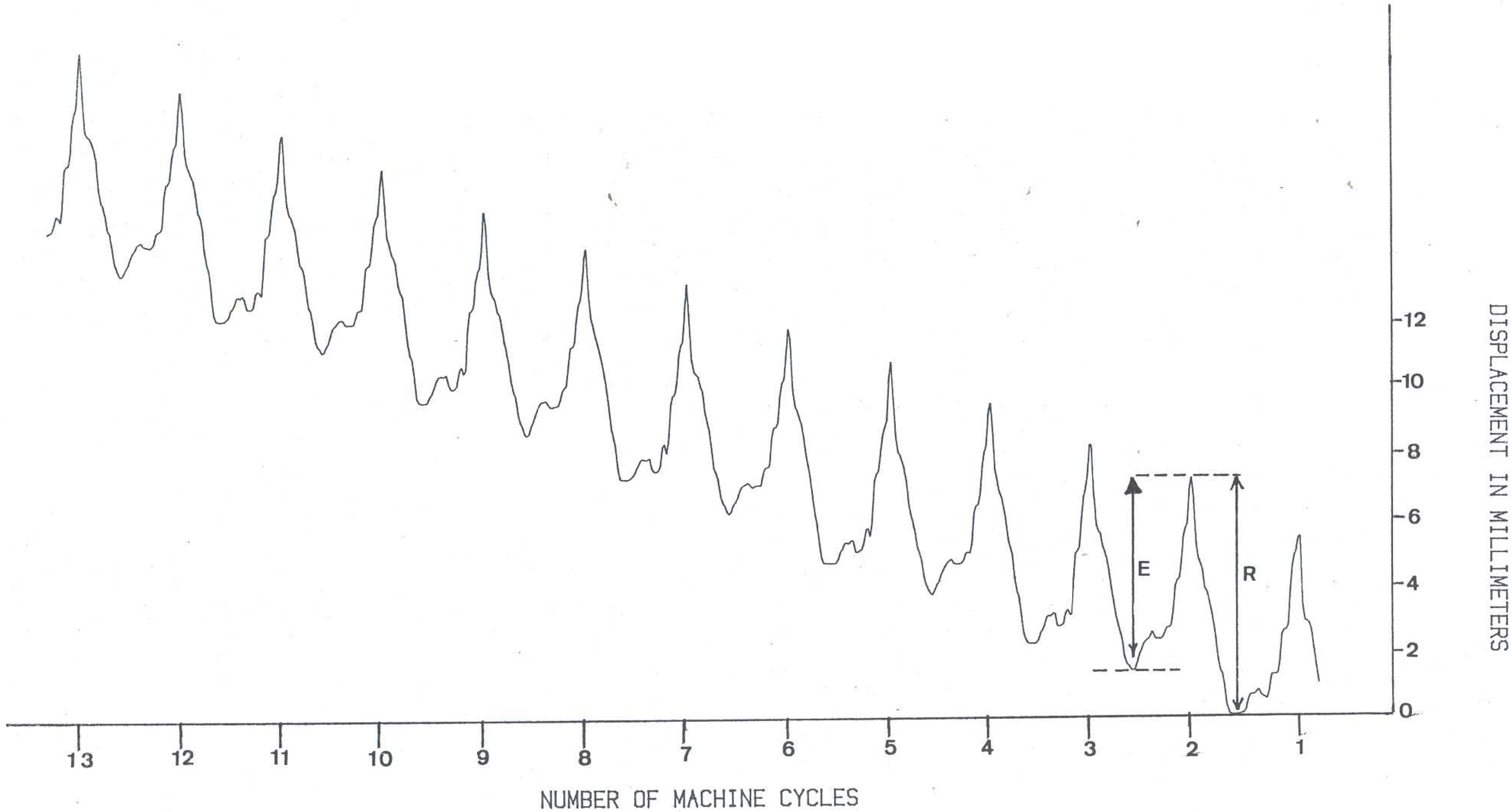


**Fig. (1.B): The Forward (R) and Backward (E) Displacements of the Fell of the Fabric At the Speed of 208 (r.p.m)**

**Table (1): The Forward (R) and Backward (E) displacements of the fell of the fabric at various loom speeds.**

| Speed (revs/min) | Forward Displacement (R) (mm) | Backward Displacement (E ) (mm) | Actual Displacement (A) (mm) |
|---|---|---|---|
| 161 | 4.76 | 3.88 | 0.88 |
| 170 | 5.00 | 4.11 | 0.89 |
| 180 | 5.23 | 4.35 | 0.88 |
| 189 | 5.93 | 5.05 | 0.88 |
| 199 | 6.63 | 5.75 | 0.88 |
| 208 | 6.87 | 5.98 | 0.89 |

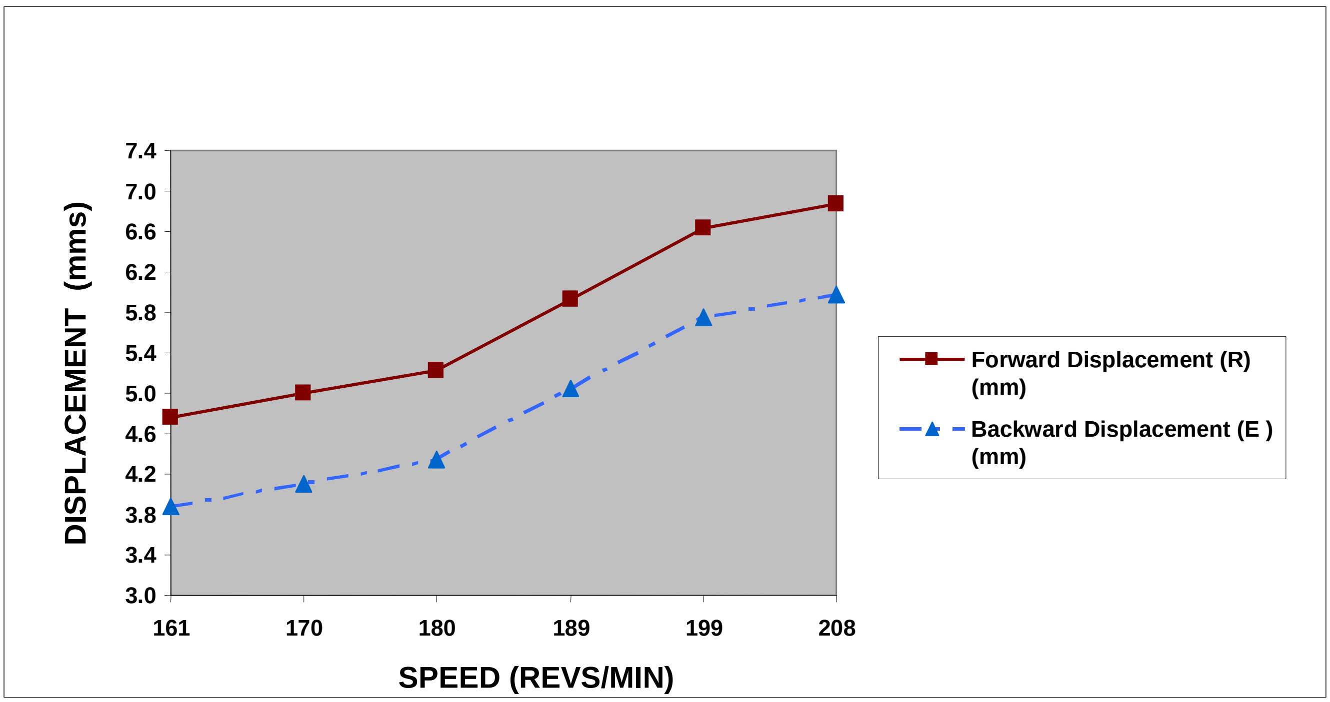


**Fig. (2): The Forward (R) and Backward (E) displacements of the fell of the fabric at various loom speeds**

## 3-2 Effect of weft density:

A Fabric was woven at 5 levels of different weft densities, 9,10,11,12 &13 picks per cm. Traces of the movement of the last- but –one pick were recorded for at least 10 picks.

Displacements R and E were measured starting from the second peak and ignoring the first one. The average values of R and E were determined. Additionally, the difference between the displacements R and E was determined for both initial beat-up and beat-up after 10 picks. The results are shown in Tables 2 and 3 respectively.

**Table (2): The Forward (R), Backward (E) and the Actual (A) displacements of the fell of the fabric at various weft densities.**

| Weft Density (picks/cm) (w) | Forward Displacement (R) (mm) | Backward Displacement (E ) (mm) | Actual Displacement A =(R-E ) (mm) | $\frac{1}{w}$ (mm) |
|---|---|---|---|---|
| 9 | 6.39 | 4.45 | 1.94 | 1.11 |
| 10 | 6.11 | 4.44 | 1.67 | 1.00 |
| 11 | 5.56 | 4.43 | 1.13 | 0.91 |
| 12 | 5.28 | 4.39 | 0.89 | 0.83 |
| 13 | 5.00 | 4.17 | 0.83 | 0.77 |

**Table (3): The stable Forward ($R_S$), Backward ($E_S$) and Actual ($A_S$) displacements of the fell of the fabric at various weft densities.**

| Weft Density (picks/cm) (w) | Stable Forward Displacement (Rs ) (mm) | Stable Backward Displacement ($E_s$ ) (mm) | Actual Displacement $A_S$ =(Rs-Es ) (mm) | $\frac{1}{w}$ (mm) |
|---|---|---|---|---|
| 9 | 3.96 | 2.64 | 1.32 | 1.11 |
| 10 | 4.17 | 2.99 | 1.18 | 1.00 |
| 11 | 4.25 | 3.19 | 1.06 | 0.91 |
| 12 | 4.30 | 3.44 | 0.86 | 0.83 |
| 13 | 4.35 | 3.54 | 0.81 | 0.77 |

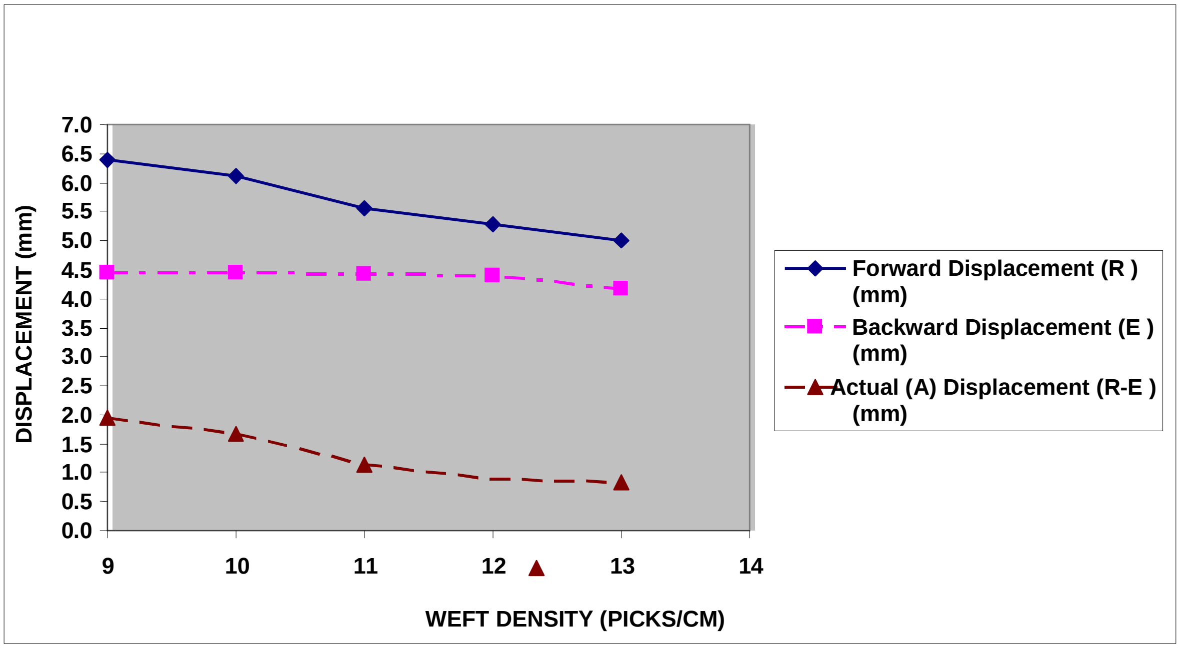


**Fig. (3):** **Initial Forward (R) and Backward (E) displacements of the fell of the fabric at various weft densities**

It should be noted that the difference (A) between the displacements (R) and (E) would be equal to the pick spacing ($\frac{1}{w}$), once stable weaving conditions have been reached. The data recorded on table (2) are plotted in Figure (3).

This Figure shows clearly that the initial forward movement (R) of the fell of the cloth decreases with the increase in the weft density. Whilst the initial backward movement (E) decreases as well but at a slower rate.

These results clearly indicate that the actual initial displacement of the yarn (A) is considerably higher at low weft densities and lower at high weft densities and vice versa. However for all experimental conditions, the results obtained showed that the value of (A) is greater than the final pick spacing ($\frac{1}{w}$). This indicates that the actual displacement (A) should be considered when selecting the suitable weft yarn diameter that should be used for a specific fabric design.

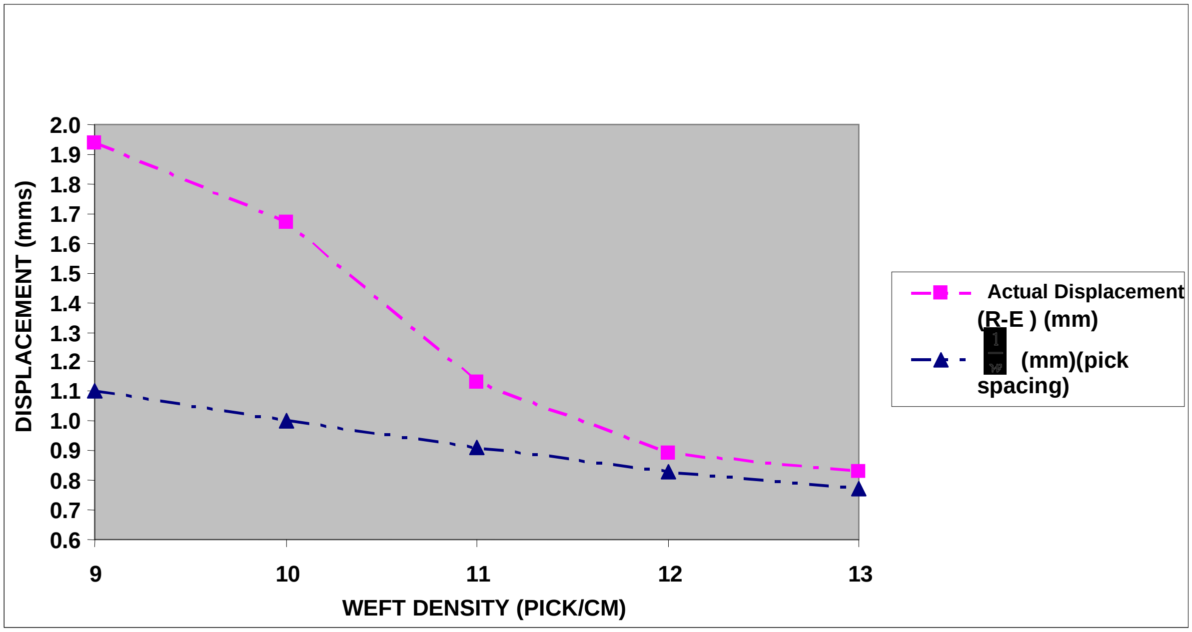


Fig. (4): **Comparison of Initial Actual Displacement (A) of the Fell of the Fabric and pick Spacing (1/w)**

These results confirm the theoretical model of plate [2] and indicate that the weft yarn is not lodged in its final position with respect to the previous pick. Figure (4) shows this effect, and additionally indicating that the difference between the actual displacement (A) and the final pick spacing ($\frac{1}{w}$) is greater at lower weft densities. This is consistent with the results observed in the energy work described by Salem [3], where it was shown that greater energy is required to beat-up the weft yarns at higher weft densities.

The results of Table (3) are plotted in Figure (5). Since ($A_s$) for all the experimental conditions, remains greater than the nominal pick spacing, then stable conditions has not been reached even after 10 picks. Further since the departure from stable conditions is greatest at low pick densities, it would be expected that a greater number of beat-ups is required to reach the stable conditions as pick density decreases.

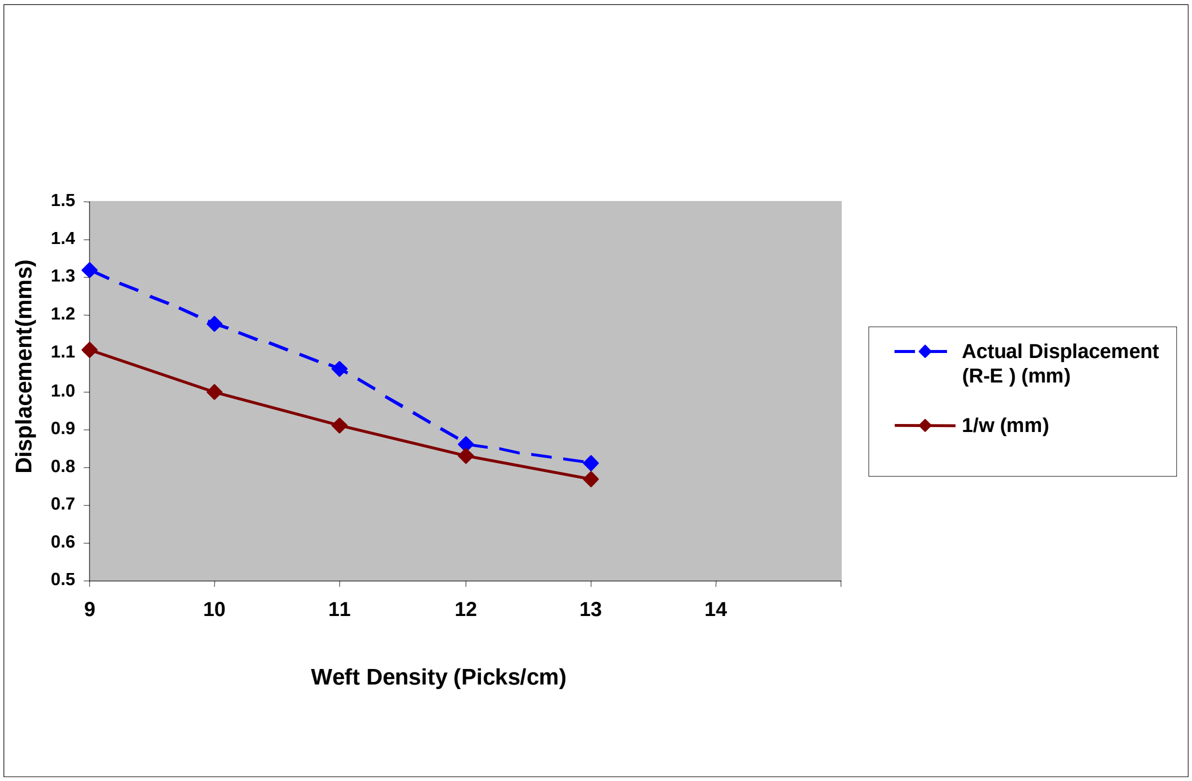


**Fig. (5):** **Comparison of ( Stable) Actual Displacemen(As) of the Fell of the Fabric and Pick Spacing (1/W)**

Figure (6) shows that $R_s$ increases as pick density increases, even though stable conditions have not quite been achieved after 10 picks. This result confirms the theoretical work of Green wood [4] which suggests that cloth fell displacement during beat-up increases with weft density.

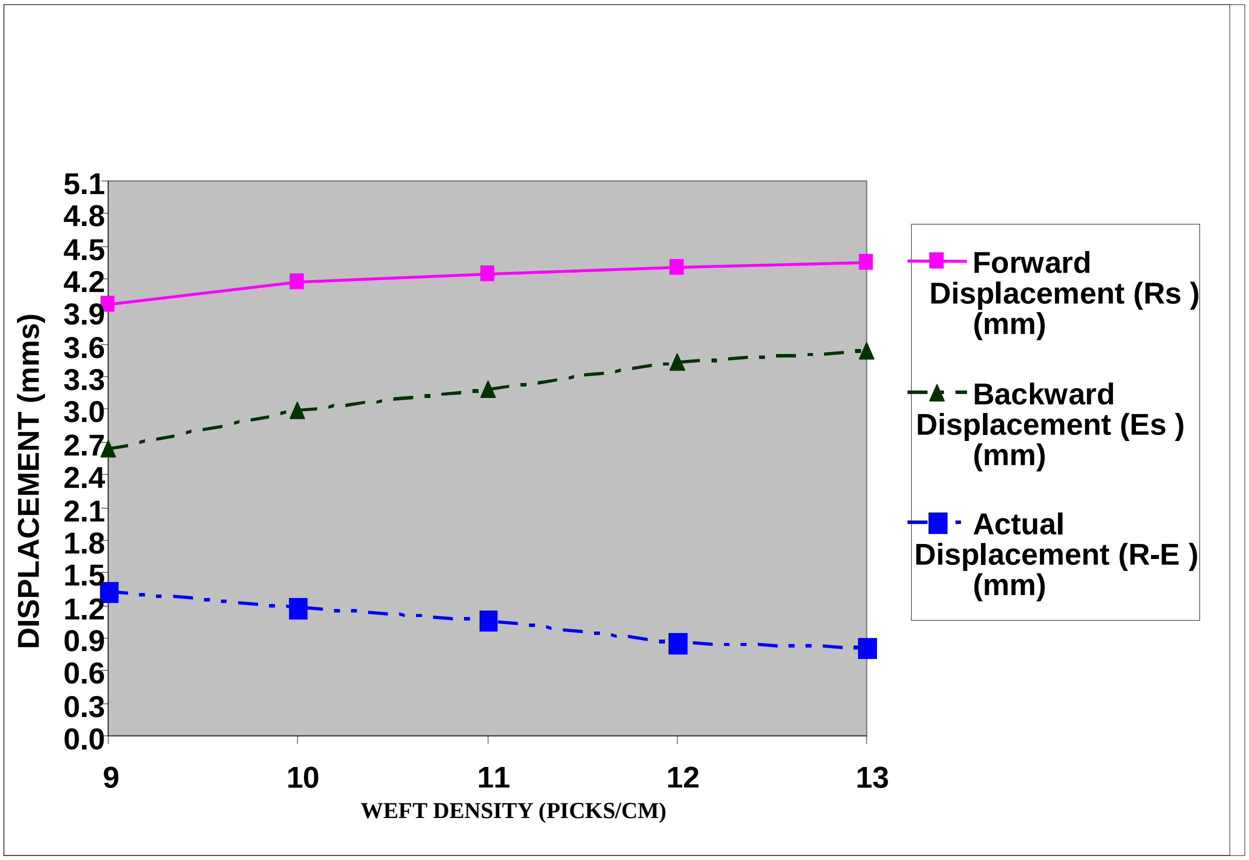


**Fig. (6): 'Stable' Forward (Rs) and Backward (Es) displacements of the fell of the fabric at various weft densities**

## 4- Conclusion:-

A very simple and forward method for measuring the cloth fell movement is developed. This technique yielded continuous records of cloth fell movement. Detailed knowledge about the cloth fell movement is obtained from the applications of this technique. These results obtained Support the theoretical findings of previous workers.

Furthermore, it could be used for studying the movements of the fell of the fabric to attain better understanding for the behaviour of the cloth fell at various loom speeds and weft densities.

## 5 - References:-

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