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عنوان البحث : تحديد أمثل الظروف لعوامل التشغيل المؤثرة على جودة الخيوط الملحومه والمنتجه بطريقه الغزل ذات الطرف المفتوح.

الخلاصة : يهدف البحث الحالى الى التوصل الى معرفه تأثير العوامل المختلفه على خواص الخيوط الملحومه من ناحيه قوة الشد ودرجه الاستطاله وذلك مقارنه بالقيم المقابله للخيوط قبل ازاله العيوب الغزليه. وقد تم دراسه تأثير نسبه خلط القطن بالياف البولى استر ، ومعامل ابى البرم ونمر الخيوط المنتجة بطريقة الغزل ذات الطرف المفتوح . كذلك تأثير بعض عوامل التشغيل على ماكينه التدوير الاوتوماتيكيه مثل قوة ضغط الهواء وطول منطقه اللحام. وقد صممت التجارب بتغير ثلاث عوامل عند ثلاث مستويات مختلفه بطريقه بوكس وبنيكان مع ثبات بقيه العوامل الاخرى وتشير نتائج البحث الى الحصول على اسطح الاستجابه التى تمثل العلاقه بين العوامل المختلفه ومتانه واستطاله الخيوط الملحومه. وتحديد التفاعل بين عوامل التشغيل (ضغط الهواء وطول منطقه اللحام) وكل من نمرة الخيط ومعامل ابى البرم ونسبه خلط القطن بالياف البولى استر.

Abstract:

In the present study, the application of Box and Behnken Factorial design to Optimize Splicing Process is demonstrated. Pneumatic splicing was examined for various Open-end yarns from cotton/polyester blends, regarding different yarn linear density, twist multiplier and fiber blend composition. Also, some parameters concerning the operating condition of the pneumatic splicing, namely lever position and twisting air pressure, were studied and their effect on the retention properties are obtained. The strength and elongation retention of spliced yarns compared to the normal open-end yarns are discussed.

1. Introduction:

Splicing is a phenomenon of joining two yarn ends during Winding (1,2,3,4,5). The accepted main advantages of the spliced joint are [5]:

(i) Adequates strength and a diameter nearly equal to yarn, with particularly no thickening.
(ii) There are no protruding ends and no knotting effect, and
(iii) The spliced yarn can be processed with less trouble in the various stages of textile production and fault frequency in the finished fabric is reduced.

The various methods of producing knot-free joint, discussed by Rohner(4) as following:

(i) Glueing, welding and wrapping techniques: are suitable in only restricted area of textile processing and create many fresh problems.
(ii) Mechanical and Electrostatic splicing : are based on opening of twist, mingling of both fiber clusters and twist insertion. The piecing appearance is ideal while they are complicated and produce insufficient strength of the yarn joints and requires long splicing time .

(iii) Pneumatic splicing : two different principles of air movement were available for pneumatic splicing operation:

- The tangential system of Technisr-vice-It is very suitable for short staple yarn.
- The *direct system is more universally applicable, ideal* for long staple yarns. and good for plied and wool worsted spun yarns.

Both systems were developed in the U.S.A and Great Britain *in the early 1960'S*, as hand splicer for filaments. The yarn ends are inserted overlapped into a chamber and are joined together by a current of compressed air, their operations in sequence: opening the twist in the free yarn end, intermingling of the fibers and binding-in of the fibers.

Recently splicing has overtaken *knotting because of better* processing[6] behaviour in weaving and knitting. Several Researcher (7,8,4,9,10) have shown that about 10% of the knots fail during mechanical processing such as the passage of yarn through the read guide, healds, and reed of the loom. The yarn breakage rate in weaving is affected by thick places, hairiness and yarn strength. Kaushik et. al. [6] studies the performance of spliced yarn *in* warping and weaving comparing with knotted yarn under industrial conditions. Spliced yarn produced significantly yarn break in both warping and weaving compared to knitted yarns.

A comprehensive study by Lünenschloss[11] considered the effect of opening air pressure, opening duration, splicing chamber form, fiber material and spinning methods. Also, they studied the influence of moisture in the pneumatic splicing of spun yarns and plied yarns[12]. Kaushik et. al.[13] examined the effectiveness of dry and wet splicing, particularly the retention properties of spliced yarns spun on ring, repco, sirospun and worsted systems. Also, they investigated the effects of yarn twist, tex and doubling on spliced yarn properties.

In the earlier work [1,7,8,9,10,11,12], the strength of a spliced yarn was shown to vary from 60% to 90% of the normal yarn depending on fiber and yarn properties. Also, the strength of the splice depends on the processing parameter of the pneumatic splicier and the yarn structure [13]. Kaushik et. al [14] estimated the strength of the *spliced yarn by considering* an idealized structure of the splice zone in two parts : The overlapping region of the two ends and the transition region in which the ends of the splice interact with the body yarn.

kaushik [6] studied the effect of splicing on yarn diameter and found that : the diameter increases at the splice zone by 25% to 36% for a range of yarn count spun from different fibers on ring spinning system. The increased diameter at the splice for rotor spun and two-fold yarn is generally greater, but wet spilicing produces a low diameter at the splice compared to dry splicing. Also the results suggested the increased in estimated mass per unit length at the splice zone should be around 70% . In addition, it indicating that the two strands to be joined are tappered and compensate each other to prevent the formation of thick places at the splices [15].

In Egyptian Textile industry, a little research work has yet been reported on the determination of the best operating conditions of spliced yarn. For ring spun, some reseacher [16,17] *have shown that the dependence of splicing joint quality* on some processing parameters. In the present study, the work was carried out on an Egyptian textile factory and a comprehensive programme of studies was constructed, in which the splicing capability was examined as a function of various parameters:

(i) *fiber and spinning parameters:* such as yarn count, twist multiplier and fiber composition in open-end yarns made from cotton/polyester blends.

(ii) Splicing process: such as lever position (i.e. the splice length) and twisting air pressure.

Also, an attempt is made to demonstrate the application of the experimental design developed by Box and Behnken [18] and the interpretation of the results for the case of three variables.

2. Experimental Work:

2.1 Materials and Methods:

Yarns were prepared from cotton/polyester blends on open-end spinning system, The retention properties of spliced yarns were examined as a function of various parameters such as : fiber, spinning parameter and splicing process variables. The splices were prepared on the pneumatic splicer of Murata automatic winder "7-II Mach Splicer" with spindle speed 1000 m/min and varying lever position, twisting air pressure and the other working conditions were kept constant.

2.2 Factorial Design :

In Box and Behnken design [18], the variables are selected at three levels namely (-1), (0) and (+1). The response surface "Y" is given by a second order polynomial as following :

$$Y = bo + \sum_{i=1}^{k} bi\ X\ i + \sum_{i=1}^{k} \sum_{j=1}^{k} bij\ X\ i\ X\ j$$

where :

$Xi = i^{th}$ Variable , K : number of Variables and bo, bi and bij : Regression coefficients associated with the varia ables .

$bo = Yo$

$bi = A\ (iy) = A \sum X\ iu\ Yu$

$bij = D\ \ (ijy)$

$bii = B\ (iiy) + C_1 \sum_{i}^{n1} (jjy) + C_2 \sum_{i}^{n2} (iiy) - (\bar{y}\ /s)$

where

A, B, C1,C2, D and S are Constant. To calculate the regression coefficients the response "y" has to be found by using different experimental combinations of the variables under consideration. In the present investigation for the case of three variables, the experimental design plan is shown in Table (1).

2.3 Construction details of Experiments:

- In the first plan : for open-end yarns made from cotton/polyester blends ($33_c/67_p$) with constant twist multiplier (αe = 5.8), It is intended to establish optimum conditions as a function of three variables : lever position (X_1), twisting air pressure (X_2) and yarn count (X_3). The actual levels of the variables are given in Table (2.1).

- In the second plan :for rotor spun yarn "Ne = 18" made from cotton/polyester blend ($75_c/25_p$), it was intersting to study the effect of the third factor, X_3 : twist multiplier in addition to the other two factors : (X_1) lever position and (X_2) twisting air pressure, as shown in Table (2.2).

- In the third plan, for open-end yarn "Ne 18" with twist multiplier αe 3.6, three factor were considered : C/P blend, lever position and twisting air pressure to study the retention properties as shown in Table (2.3).

Table (1) Experimental plan for three variables

Combination No	Levels of Variables X_1	X_2	X_3	Interactions X_1^2	X_2^2	X_3^2	X_1X_2	X_1X_3	X_2X_3	Response Yi
1	-1	-1	0	1	1	0	1	0	0	Y1
2	-1	1	0	1	1	0	-1	0	0	Y2
3	1	-1	0	1	1	0	-1	0	0	
4	1	1	0	1	1	0	1	0	0	
5	-1	0	-1	1	0	1	0	0	0	
6	-1	0	+1	1	0	1	0	1	0	
7	1	0	-1	1	0	1	0	-1	0	
8	1	0	1	1	0	1	0	-1	0	
9	0	-1	-1	0	1	1	0	1	1	Y9
10	0	-1	1	0	1	1	0	0	-1	
11	0	1	-1	0	1	1	0	0	-1	
12	0	1	1	0	1	1	0	0	1	
13	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	Y15

Table (2.1)

Variables	Levels -1	0	+1
X_1: lever position (l_n)	2	4	6
X_2: twisting pressure (bar)	3	4.5	6
X_3: yarn count "Ne"	18	22	26

Table (2.2)

Variables	Levels -1	0	+1
(X_1) lever position	2	4	6
X_2: twisting air pressure	3	4.5	6
X_3: twist multiplier ($\propto e$)	3.6	4.7	5.8

Table (2.3)

Variables	levels -1	0	+1
X_1: lever position (l_n)	2	4	6
X_2: twisting air pressure (bar)	3	4.5	6
X_3: cotton/polyester blend ratio	75c 25p	33c 67p	100p

Table (3)

Response	Response Surface Equations	Correlation Coefficients
1st Case :		
1. Yarn strength (Rst%)	$Y = 65.95+2.925X_1-0.288X_2+22.8X_3 - 3.85X_1^2-11.68X_2^2+9.28X_3^2 + 1.098X_1X_2-2.053X_1X_3+0.05X_2X_3$	0.941
2.Yarn Extension (Re%)	$Y = 75.66+2.225X_1-7.463X_2+3.013X_3 - 15.443X_1^2-6.318X_2^2-16.868X_3^2 - 8.75X_1X_2-2.90X_1X_3-2.225X_2X_3$	0.760
2nd Case :		
1.Yarn Strength (Rst%)	$Y = 71.513+1.738X_1+3.363X_2-8.60X_3 - 2.791X_1^2-5.841X_2^2+10.534X_3^2 - 3.90X_1X_2+1.58X_1X_3+0.125X_2X_3$	0.934
2. Yarn Extension (Re%)	$Y = 81.173-0.338X_1+4.013X_2-2.55X_3 + 10.934X_1^2-0.066X_2^2-1.041X_3^2 - 4.50X_1X_2-4.325X_1X_3+2.625X_2X_3$	0.760
3rd Case:		
1.Yarn Strength (Rst%)	$Y = 62.380-0.475X_1+4.025X_2-20.35X_3 + 0.362X_1^2+0.012X_2^2+5.962X_3^2 + 4.175X_1X_2-1.075X_1X_3-0.275X_2X_3$	0.985
2.Yarn Extension (Re%)	$Y = 69.207+0.213X_1+0.363X_2-15.30X_3 + 4.909X_1^2+0.909X_2^2-2.866X_3^2 + 4.25X_1X_2-3.725X_1X_3-1.075X_2X_3$	0.875

2.4. Measurements:

For spliced yarn, the tensile strength and elongation were determined while having always the splice within the tested sample length. The sample length between clamps 50 Cm, each of the yarn specimen examined contained only splicing. The average of 30 reading for each sample were refered to the actual mean value of the original yarn. The required parameters were calculated from the following expressions:

$$\text{Rst\%, Relative strength} = \frac{\text{Strength of spliced yarn}}{\text{Strength of parent yarn}} \quad ...(1)$$

$$\text{Re\%, Relative elongation} = \frac{\text{elongation at break of spliced yarn}}{\text{elongation at break of parent yarn}} \quad ...(2)$$

3.Experimental Analysis :

The results were fed to mini-computer, and regression coefficients were determined. The response surface equations for the relative yarn strength and extension at break are given in Table (3), with correlation coefficients between the experimental and calculated values obtained from the surface equations.

4.Results and Discussion:

4.1 Strength Retention (Rst%)

4.1.1 Interaction between Yarn Linear density,lever position and twisting air pressure:

Figures (1.1), (1.2) and (1.3) shows the effect of lever position (X1), twisting air pressure (X2) on strength retention (Rst%) for different O.E yarn count (X3) made from cotton / polyester blend ($33_c/67_p$) at twist multiplier "αe5.8".

The experimental results are given in Fig (1) indicate that the influence of yarn count "or yarn linear density" on splicing strength. The contour lines are ellipses with a maximum falling inside The experimental field of *X1 and X2 variables*. It shows that there is a displacement of their centre on passing from heavier to lighter yarn linear density. The variation in strength retention for yarn count "Ne 18" is about 30% to 51%, 45% to 67% for yarn count Ne 22, and it ranged from 82% to 96% for yarn count Ne 26. Also, it can be seen that, the strength retention (Rst%) increases when yarn linear density decreases from 33 tex to 21 tex. This is in agreement with the mean rate of splice strength for different count made from 100%c,c/p blend and 100% pdyester, which obtained through the instructions given by Murata [20].

The variation in twisting air pressure (X2) give a significat effect on strength retention. An increase of strength retention with increasing twisting pressure between X2 = -1 and X2 - 0, is observed and a higher values of Rst % attains at twisting air pressure 4.5 bar (ie X2 = 0). Also,it seems that this level of twisting pressure in splicer and splicing length corresponding to lever position ln 4 ÷ 6 may be helpful mainly in opening of the fiber strand. This may be explained by increasing the twisting air pressure will increase the twist inserted into the yarn joint which will increase Its compactness. Due to that the strength retention will increase. on the other hand, beyond this level of twisting air pressure there was a substiantial decrease in yarn strength.

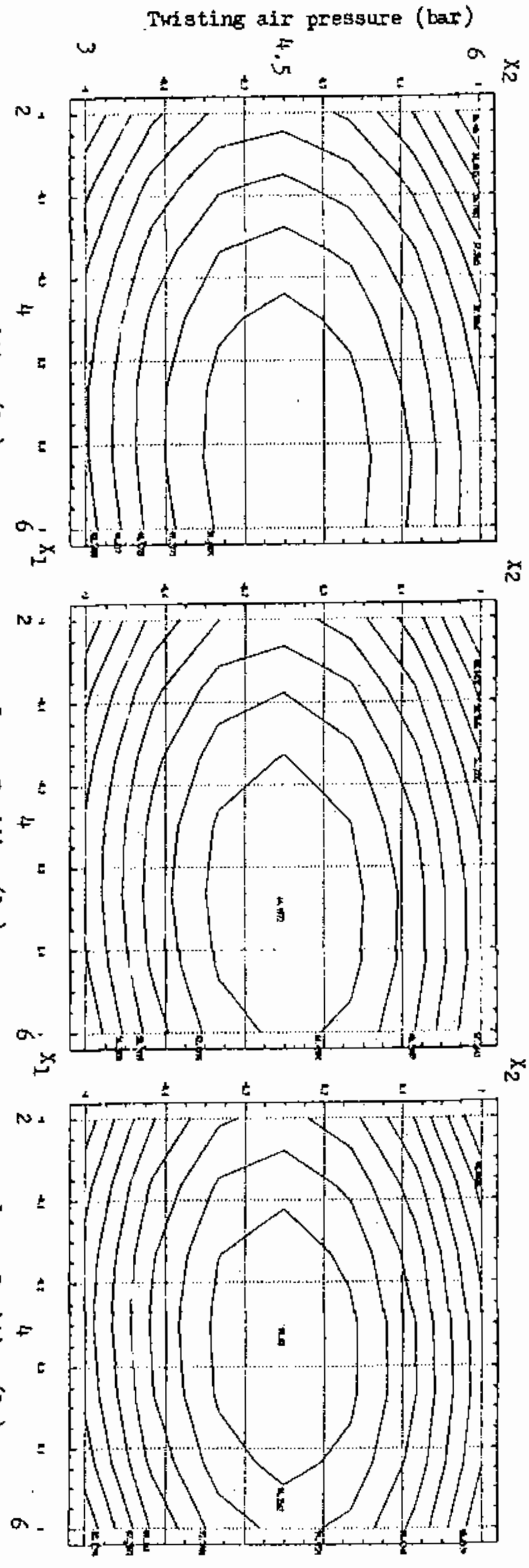
The relationslip, Fig (1), indicate that the increase in lever position (ln), decreasing the splice length, has increased the strength retention (Rst%) from 4% to 12% for $33_c/67_p$ blended yarn with αe 5.8. This trend is particularly prominent in coarse count "Ne 18" at different twisting air pressure, while for medium count Ne 26 a slight change has been observed with decrease in splicing length.

4.1.2. Interaction between twistmultiplier, lever position and twisting air pressure:

For open-end yarn "Ne 18" made from cotton/polyester blend ($75_c/25_p$), figures (2.1), (2.2) and (2.3) shows the effect of lever position and twisting air pressure for different yarn twist *multiplier* (αe 3.6 to 5.8) on relative strength of spliced yarns.

The contour lines for breaking strength retention conform to be an ellipses shape, through there is a displacement of their centre on passing from Low to high twist multplier (αe 3.6 to αe 5.8). At low twist multiplier (αe 3.6) breaking strength retention varied from 75% to 90% and was much higher than these obtained for high twist (αe 5.8), which varies between 56% and 70%. These results, clearly show that an increase in twist of open-end yarns, results in a deterioration in breaking load of spliced yarn. The adverse effect on Rst%, higher twist multiplier leads to less Rst% values, is attributed to the inserted twisting air pressure in splicing zone will not attain the required turns per unit length which will tend to a decrease in strength retention.

The contour lines, in Fig. (2), shows that increasing the twisting air pressure will increase *strength retention* (Rst%). Also, it can be seen that for ($75_c/25_p$) blend contain higher percent of cotton fibers, a better values of breaking strength retention

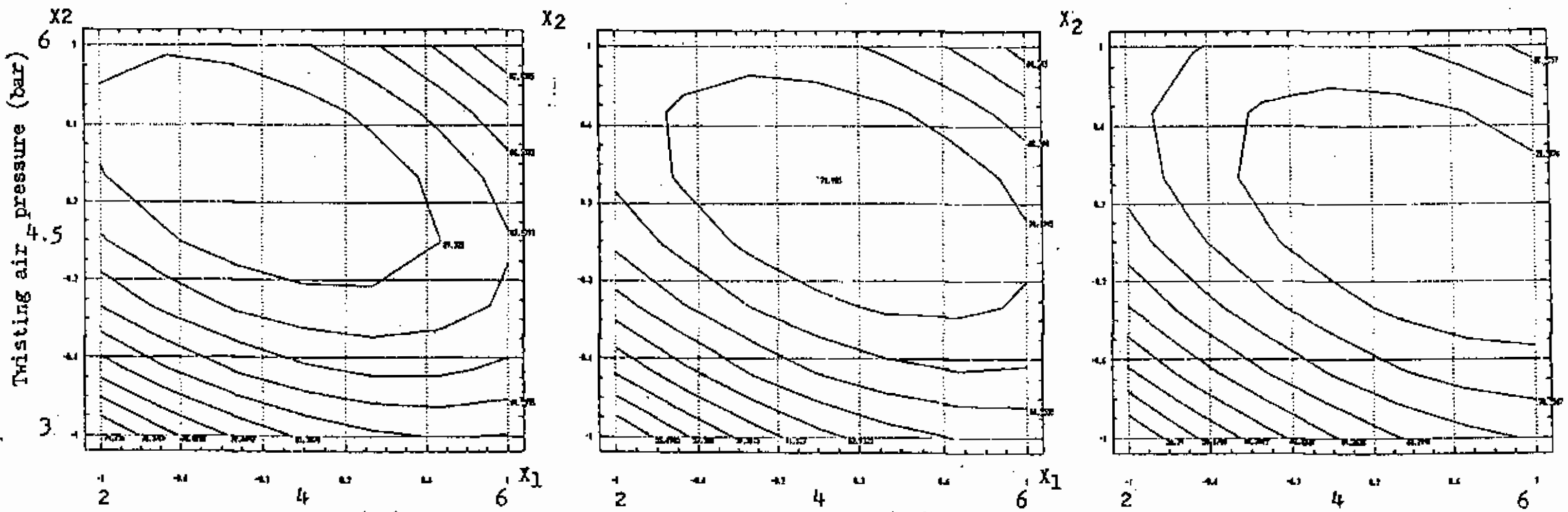


lever position (l_n)
Fig.(1.1) Contours for R_{st} (%)
(x_3= -1) N_e 18; αe 5.8

Lever Position (l_n)
Fig.(1.2) Contours for R_{st} (%)
(X_3= 0) N_e 22; αe 5.8

Lever Position (l_n)
Fig.(1.3) Contours for R_{st} (%)
(X_3= +1) N_e 26; αe 5.8

Fig.(1) Effect of yarn linear density, twisting air pressure and lever position "splice length" on relative strength of open -end (33_c/ 67_p blend) spun yarns.



Lever Position (l_n)
Fig. (2.1) Contours for R_{st} (%)
(X_3= -1) α_e 3.6; N_e 18

Lever Position (l_n)
Fig.(2.2) Contours for R_{st} (%)
(X_3= 0) α_e 4.7; N_e 18

Lever Position (l_n)
Fig. (2.3) Contours for R_{st} (%)
(X_3=1) α_e 5.8; N_e 18

Fig.(2) Effect of yarn twist multiplier, twisting air pressure and lever position" splice length" on relative strength of open end (75_c/ 25_p blend) spun yarns.

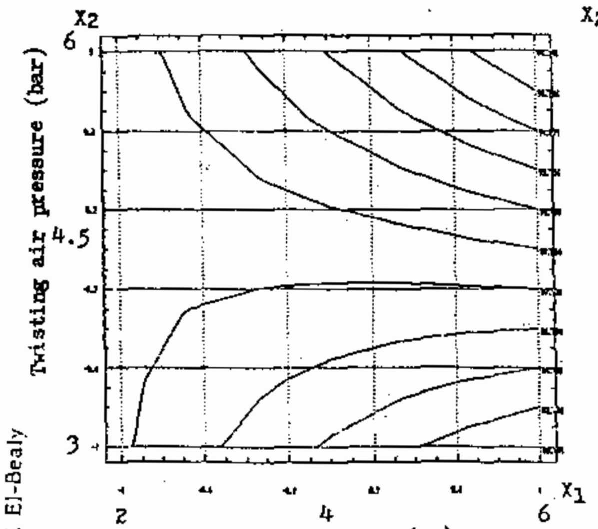


Fig.(3.1) Contours for R_{st} (%)
(X_3= -1) 75_c /25_p blend
(N_e 18; α_e 3.6)

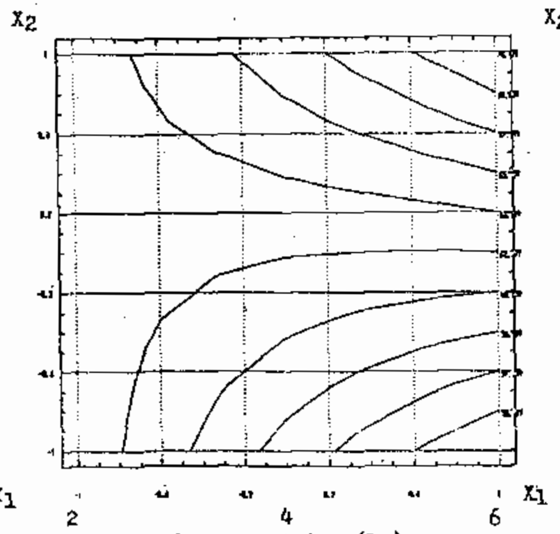


Fig.(3.2) Contours for R_{st} (%)
(X_3 = 0) 33_c /67_p blend
(N_e 18; α_e 3.6)

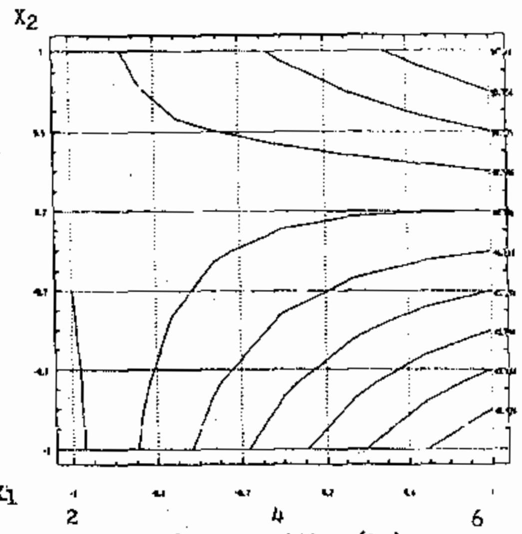


Fig.(3.3) Contours for R_{st} (%)
(X_3 = +1) 100% polyester
(N_e 18; α_e 3.6)

Fig.(3) Effect of fibre blend composition "C/P ratio", twisting air pressure and lever position "splice length" on relative strength of open end blended spun yarns.

is attain at higher rate of twisting air pressure (X2= 0 to X2 = - 1) and lever position upto L_n= 4 (long splice length).

In terms of the effect of lever position, Fig. (2) show that increasing the splicing length for roter spun ($75_c/25_p$) yarn will increase the Rst%. This is compatible with the earlier study [16] . It was mentioned that, since splice length is increased by increasing the length of the two twisted tails, from that the degree of fibers entanglement will increase. Due to that, the frictional force between fibers will be greater and the yarn strength will be increase. The curves illustrate the rate of increasing in breaking strength retention which is about 8% to 12% at low twisting air pressure (X_2= -1), while it ranged from 1% to 4% at normal pressure (X2=0). On the other hand beyond this level of twisting pressure (at X_2= +1) there was a substantial drop in strength retention (Rst%) (2% to 8%) with varying the lever position (from X1=-1 to X1= +1).

4.1.3 Interaction between fiber blend composition, lever position and twisting air pressure:

Open-end yarns (Ne 18) made from cotton/polyester blend ($75_c/25_p$) and $33_c/67_p$) and 100% polyester with low twist multiplier(αe 3.6) were spliced and the results of strength retention as a function of splicing parameters are illustrated graphically in Fig. (3).

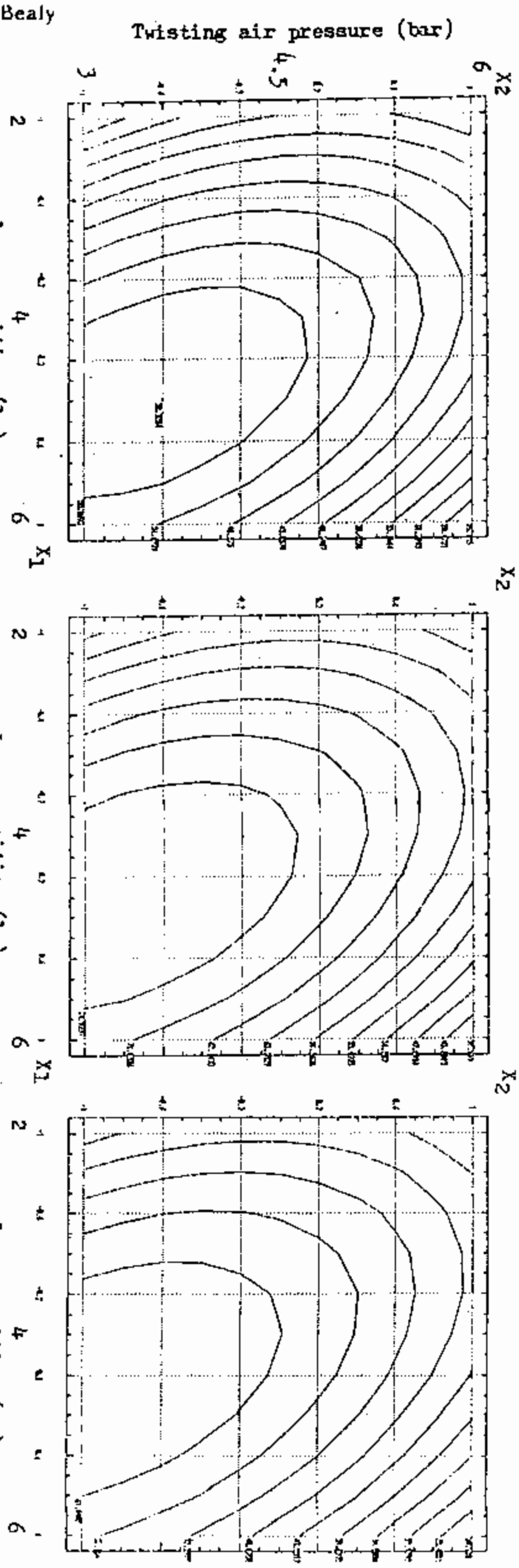
In terms of fiber blend composition, the contour lines shows the strength retention Rst% varies between 80% and 98% for $75_c/25_p$ blend and for $33_c/67_p$ blend it ranged from 55% to 70%. while Rst% for 100% polyester yarn ranged from 40% to 54%. Also, it can be seen that, the increase of polyester fiber content in the blends decreases the strength retention of spliced yarn. In addition the value of Rst% depend on the level of chosen splicing parameters through experimentation.

For all blends, in the present investigation, at low twisting air pressure (X_2= -1) the variation of lever position from X1= +1 to X1= -1, i.e increasing the splicing length causes an increase in breaking strength retention approxi. 8%. The values of Rst% remains constant at twisting pressure (X2=0) with increasing the splice length. while the curves shows that, at high twisting pressure X2= +1, the increasing the splicing length causes a substantial drop in strength retention from 6% to 9%.

On the other hand, for the same level of lever position within the range X1= -1 to X1= 0,The increase in twisting air pressure causes a slight change in breaking strength retention (Rst%) = 1%.while beyond this level, from ln 4=6,The strength retention increases by 14% to 18% as the twisting air pressure increases.
The minimum incidence of breaking strength retention (Rst%) seems to occurs at Low twisting air pressure and short splice length and the obtainable values depend on the polyester fiber content in Open-end (cotton/polyester)blended yarns. These results are in agreement with the machine manufacturer recomdnoation [20]. On the other hand, The obtained results differs from that obtained by kaushik et. al. [6]. They found that fer rotor spun yarn an increase in the proportion of polyester fibers in the blends increases the splice length.

4.2 Elongation Retention (Re%):

The effect of yarn linear density, twisting air pressure and lever position on elongation retention of open-end yarns made from cotton/polyester blend ($33_c/67_p$)

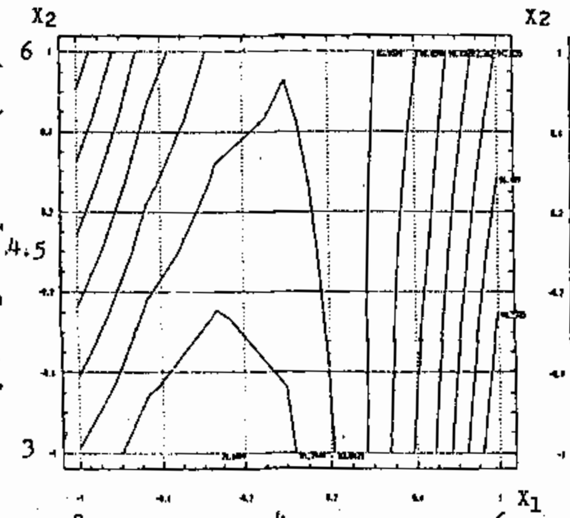


Lever position (l_n)
Fig.(4.1) Contours for R_e (%)
(X_3= -1) Ne 18; αe 5.8

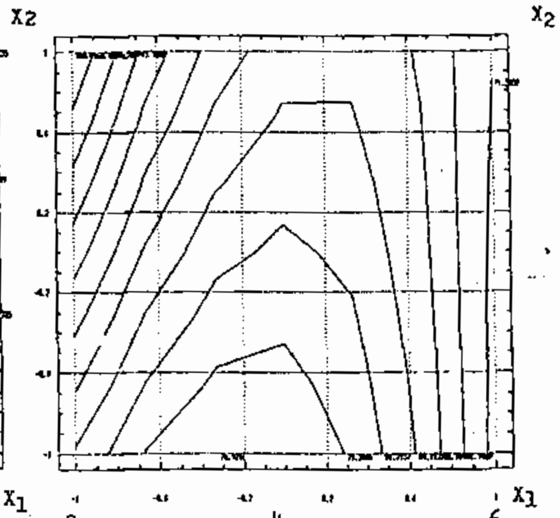
Lever position (l_n)
Fig.(4.2) Contours for R_e (%)
(X_3= 0) Ne 22; αe 5.8

Lever position (l_n)
Fig.(4.3) Contours for R_e (%)
(X_3= +1) Ne 26; αe 5.8

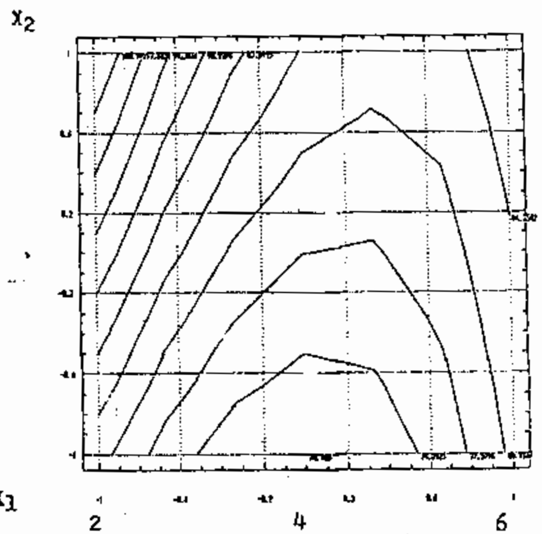
Fig. (4) Effect of yarn linear density, twisting air pressure, and lever position splice length* on relative elongation of open end (33_c/ 67_p blend) spun yarns.



Lever position (l_n)
Fig.(5.1) Contours for R_e (%)
(X_3= -1) α_e 3.6; N_e 18



Lever position (l_n)
Fig.(5.2) Contours for R_e (%)
(X_3= 0) α_e 4.7; N_e18



Lever position (l_n)
Fig.(5.3) Contours for R_e (%)
(X_3= +1) α_e 5.8; N_e 18

Fig.(5) Effect of yarn twist multiplier, twisting air pressure and lever position "splice length" on relative elongation of open end (75_c/ 25_p blend) spun yarns.

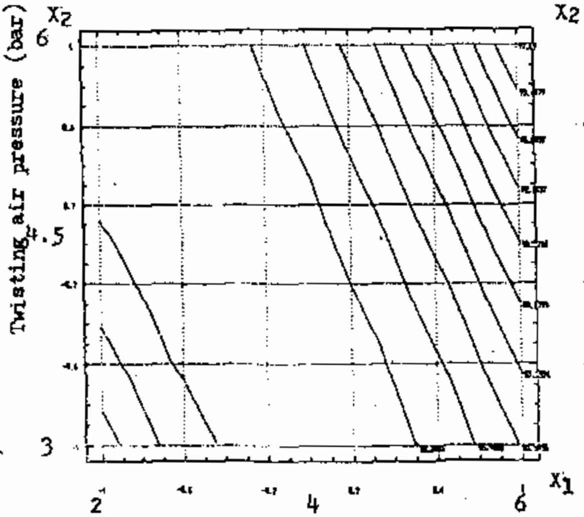


Fig.(6.1) Contours for R_e (%)
(X_3 = -1) $75_c/25_p$ blend
(N_e 18; α_e 3.6)

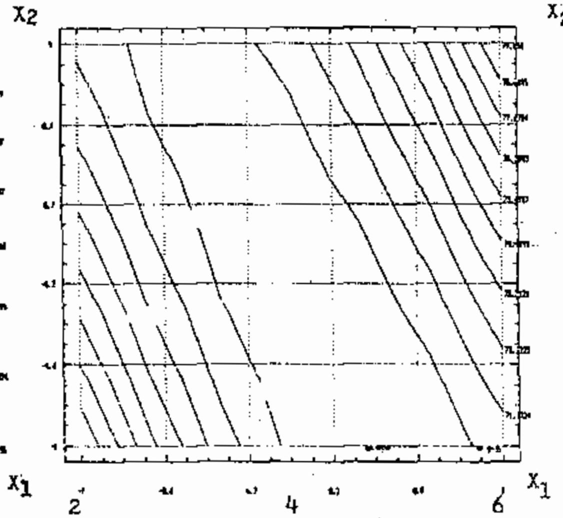


Fig.(6.2) Contours for R_e (%)
(X_3= 0) $33_c/67_p$ blend
(N_e 18; α_e 3.6)

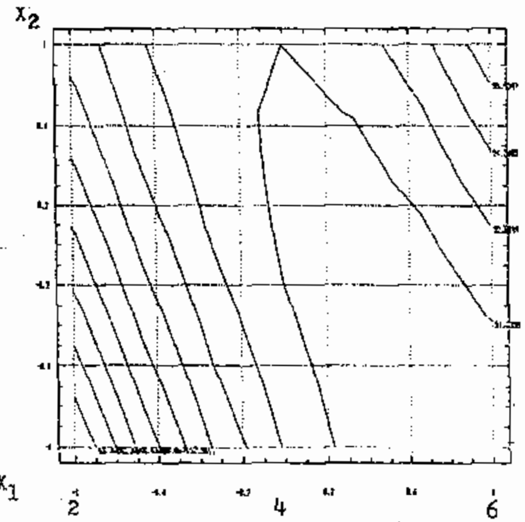


Fig.(6.3) Contours for R_e (%)
(X_3= +1)100% polyester
(N_e 18; α_e 3.6)

Fig.(6) Effect of fibre blend composition "C/P ratio", twisting air pressure and lever position "slice length" on relative elongation of open end blended spun yarns.

with twist factor αe 5.8, is shown in Fig. (4).
The maximum values of Re% occurs at twisting air pressure, from X2 =-1 to X2 = 0, and normal splice length which corresponding to lever position In="4". Also, it is clearly that the Re% values are greater for yarn count "Ne 26", Is about 71%, than that obtained for coarse count Ne 18 approxi 58%.

The results of Re% for open-end yarn "Ne 18" made from cotton/polyester blend (75c/25p) due to the effect of twist multiplier, twisting air pressure and lever position are shown in Fig. (5). The contours show that, the Re% is ranged from 78% to 100 % for twist multiplier αe 5.8, while it varies between 80% and 94% for twist multiplier αe 3.6. In the mean time, it is observed that increasing twisting air pressure causes an increase in elongation retention. The rate of increase in Re% is greater for high twist, it ranged from 14% to 20%, than those obtained for low twist multiplier (up to 11%). The minimum values of Re% occurs at lower twisting air pressure (X2=-1) and splice length corresponding to lever position In=4.

The effect of fiber blend composition "c/p blend", twisting air pressure and splice length on the breaking extension retention for O.E yarn (Ne 18, T.F 3.6) is shown in Fig. (6). The contours show that, the Re% is greater for 75c/25p blended yarn, it ranged from 82% to 96%, than those obtained for 33c/67p (69% to 80%) and (51% to 64%) for 100% polyester yarns . Also, it can be noticed that, for c/p blends contain higher polyester percentage, The maximum values of Re% attains at short splice length "In=6" and higher twisting air pressure".

5 - Conclusion s :

The present study permits the following conclusions to be drawn :

The factorial design technique allow to determine for open-end yarns the most suitable working condition of splicing on automatic winding machine. Also, the results shows the influence of material and spinning variables and its interaction with splicing process on yarn retention properties. The analysis leads to very intersting results as follow:

1) The break strength and elongation of a spliced Open-end yarns are affected by:

(i) Twist Multiplier

- An increase in yarn twists (αe 3.6 to αe 5.8) leads to a drop in strength retention of spliced yarn. The Rst% values of O.E yarn spun from 75c/25p blend, ranged from 75% to 90% for low twist multipler is higher than that for high twist, approxi. from 56% to 70%.

- The breaking elongation retention Re% increases considerably as twist multiplier increases. The rate of increase in Re% for O.E yarn (75c/25p), ranged from 14% to 20 % at twist"αe 5.8" is higher than that for low twist"αe 3.6" approxi. up to 11%.

(ii) Fiber blend composition "C/p ratio" :

- An increase of polyester content in C/p blend from 25%p to 100%p leads to a deterioration in strength retention of O.E spliced yarn. Also higher Rst% values, 80% to 98%,was obtained for 75c/25p blend than those for 100% polyester yarn (40% to 54%).

- The same trend has been observed for elongation retention. The Re% varied from 82% to 96% for 75c/25p blend was much higher compared to 100% polyester yarn approxi. 51% to 64%.

(iii) Yarn Linear Density:

- Strength retention increases when yarn linear density decreases. The medium yarn count had higher breaking strength retention. It varied from 82% to 96% for yarn count Ne 26 was much higher than that for coarse count Ne 18,approxi. 30% to 51%.

- Also, an increase in yarn count "Ne" leads an increase in elongation retention. The Re% value for Ne 26 spun from 33c/67p blend (71%) is higher than that fer Ne 18, approxi. 58%.

2) The relationship between splicing process and Open-end yarn strength retention indicate that:

(i) Regarding to the effect of twisting air pressure, the results indicate that, an increase in twisting air pressure show a significant change in Open-end yarn strength retention.

- for different yarn counts made from 33c/67p blend, an increase of strength retention occurs at twisting pressure from X2= -1 to x2= 0, and for short splice length"Ln 4≃6".

- For different twist multiplier: an increase in twisting air pressure, from X1= 0 to X1= +1, at lever position Ln up to ≃4 "long splice length" causes an increase in the strength retention Rst% of 75c/25p blended yarn.

- For C/p blend contain high pelyester percentage, there is a slight change ≃ 1% in strength retention as twisting air pressure increases and long splice length. on the other hand, for short splice length "Ln 4≃6" an increase in twisting pressure results in an increase in strength retention (from 14% to 18%).

(ii) In terms of lever position "or splice length", it is evident that:

An increase in splicing length causes an increase in strength retention at low twisting air pressure. The rate of increase in Rst% is about 8% to 12%. Also, a slight change up to 4% occurs at normal twisting pressure. on the other hand, the strength retention decreases when the splice length increased at high twisting air pressure. The rate of drop in strength retention is ranged between 2% to 9%.

3) The relationship between splicing parameters and O.E yarn elongation retention: The relative elongation Re% do not depends only on fiber blend composition, yarn count and twist multiplier, but also on the splice length and twisting air pressure.

- A better values of Re% attains for 75c/25p blend yarn at higher twisting air pressure and long splice length (i.e. lever position Ln=2).

- For 33c/67p blended yarn, the maximum values of Re% occurs at twisting air pressure from X2= -1 to X2=0, and normal splice length corresponding to lever position Ln=4.

- For 100% polyester yarn, the maximum values of Re% occurs at short splice length "Ln = 6" and higher twisting air pressure.

4) The results reported here clearly justify the effect of material, O.E yarn properties and splicing parameters on the retention properties of spliced yarn. Also, it can

not be generallized for cases other than the experimentation considered here.

5) Further studies will extend the scope of the present work, concerning the surface appearance of spliced yarn.

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