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# A Study of Some Factors Affecting the Quality of Carded Sliver on High Production Card.

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# A Study of Some factors affecting the quality of Carded Sliver on high production Card.

# دراسة بعض العوامل المؤثرة على جودة اشرطة الكرد المنتجة على ماكينات الكرد عالية الانتاج.

By
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خلاصـــــة :

استخدمالا لدراسة تاثير سرعات وضبطات ماكينة الكرد عالية الانتاج ى جودة الاشرطة المنتجة منها فان هذا البحث يتركز على دراسة بعض الضبطات ماكينة الكرد مثل الضبطات بين صحن التغذيـــة والمنقـــار ، المنقـــار السلندر ، السلندر والفلاتس وبين السلندر والدوفر عند تغذيل الالطـــان مصرية ( جيزة ٧٥ وجيزة ٨٠ ) . وقـــد صممت التجارب بتغيير الاربعـة عوامل ـــابقة عند مستويين (٢) ومن النتائج امكن تحديد التاثير المعنوى للضبطات ، على حدة وكذلك تفاعلات هذه العوامل وكذلك نوع التغيرات على جودة الفريط لناتج وذلك بحساب عدد العقد بقافة الكرد وانتظامية الفريط . وقد وجد ان دد العقد فى القافة يتاثر معنويا بقيم الضبطات بيـــن السلنـــدر والدوفـــر السلندر والفلاتس وكذلك تتاثر بتفاعلات هذه العوامل . كما وجد ان انتظامية فريط الناتج تتحسن بتضييق المسافات بين الاجزاء التى تم دراستـــها لـــى ماكينة الكرد فى اتجاه مسار القافة .

## ABSTRACT

In the present investigation two types of Egyptian Cotton Fibres were processed through higher production m/c into Carded sliver . The experiments were Carried out by varying Four parameters ( Card settings ) at Four positions at two levels . Using $2^4$ Factorial design technique. The sliver quality in terms of uster eveness c.v. % and Card weh neps /100 $inch^2$ were determined .

The experimental results explored the influence of settings between m/c parts on the cotton sliver quality . The results show that the lower rate of neps in the card web is obtained at closer setting between cylinder and doffer and between cylinder and flats , The better sliver regularity resulted by decreasing the discussed setting in the material flow direction . The factors interactions show significant effect on the sliver quality .

## 1-Introduction

Several Research Workers (3,4,5) Studied the effect of flat carding machine variables on cotton Sliver quality . The card sliver quality was affected significantly by several factors such as : the speed of carding machine organs (11) the setting between these parts (6) the load applied to their surfaces (8). the doffing factor between cylinder and doffer (7) and state of carding cloth (9) .Also they studied the cleaning efficiency of the carded sliver (10), as well as the sliver and yarn evenness (4,5).

The auther (1) studied the dependence of card web neps and trash Content % in card sliver in carding organs speeds , cotton fibre and sliver weight . Thus ,the present work intended to study the influence of card setting on cotton sliver quality . The experiments were carried out cosidering the following :
- Varying four settings at carding m/c : dishplate to takar-in , taker-in to cylinder, cylinder to flats and cylinder to doffer using $2^4$ factorial design technique (2) .
-Two egyptian cotton fibres were processed on Toyoda high production machine .

## 2-Experimental work :

2-1 Material : the experiments were carried out on two types of Egyptian cotton fibres , Giza 75 and Giza-80 having the following properties :

| Fiber Properties | | Cotton fibre | |
|---|---|---|---|
| | | Giza 75 | Giza 80 |
| length at | 2.5 % | 30.50 | 32.4 |
| | 50. % | 13.88 | 14.0 |
| | U.R.% | 45.50 | 43.2 |
| Micronaire | μ g/in | 4.500 | 3.70 |

Table (1) : The Properties of processed Cotton

2-2 Factorial design The $2^4$ factorial design technique applied to investigate the effect of carding machine settinge on the card sliver quality . Four positions between dishplat-taker-in , taker-in-cylinder , cylinder-flats and cylinder-doffer were considered . The actual levels of setting between carding m/c elements ranged at two levels (-1) and (+1) given in Table (2) , while the experimental plan is shown in table (3) .
Cotton fibres es a lap was proceesed through TOYODA CK-C7 high production carding m/c for producing sliver of Ne 0.15

| Variables | lsvel | -1 | +1 |
|---|---|---|---|
| $X_1$ : Cylinder to doffer | setting (in) | 0.004 | 0.008 |
| $X_2$ : Taker-in to cylinder | setting (in) | 0.006 | 0.012 |
| $X_3$ : Dishplate to taker-in | setting (in) | 0.008 | 0.016 |
| $X_4$ : Cylinder to flats | Setting (in) | 0.010 | 0.014 |

Table (2) : Actual levels of variables

| Experimental Number | level of variables | | | | Response $Y_i$ |
|---|---|---|---|---|---|
| | $X_1$ | $X_2$ | $X_3$ | $X_4$ | |
| 1 | + | + | + | + | $y_1$ |
| 2 | + | + | + | − | ⋮ |
| 3 | + | + | − | + | ⋮ |
| 4 | + | + | − | − | ⋮ |
| 5 | + | − | + | + | ⋮ |
| 6 | + | − | + | − | ⋮ |
| 7 | + | − | − | + | ⋮ |
| 8 | + | − | − | − | $y_8$ |
| 9 | − | + | + | + | ⋮ |
| 10 | − | + | + | − | ⋮ |
| 11 | − | + | − | + | ⋮ |
| 12 | − | + | − | − | ⋮ |
| 13 | − | − | + | + | ⋮ |
| 14 | − | − | + | − | ⋮ |
| 15 | − | − | − | + | ⋮ |
| 16 | − | − | − | − | $y_{16}$ |

Table (3) : Experimental plen :

| Exp.No. | Cotton sliver quality: Neps / 100 inch$^2$ | | Carded sliver evensss(CW) | |
|---|---|---|---|---|
| | Giza 75 | Giza 80 | Giza 75 | Giza 80 |
| 1 | 12 | 18 | 6.38 | 6.51 |
| 2 | 12 | 15 | 5.71 | 5.39 |
| 3 | 20 | 50 | 7.45 | 9.03 |
| 4 | 0 | 9 | 5.89 | 5.43 |
| 5 | 6 | 18 | 6.94 | 6.14 |
| 6 | 5 | 7 | 7.31 | 5.07 |
| 7 | 4 | 9 | 6.50 | 7.30 |
| 8 | 5 | 6 | 7.55 | 5.20 |
| 9 | 13 | 24 | 5.61 | 6.87 |
| 10 | 12 | 27 | 6.55 | 5.66 |
| 11 | 23 | 24 | 6.46 | 4.85 |
| 12 | 14 | 9 | 4.23 | 6.38 |
| 13 | 39 | 44 | 7.77 | 6.24 |
| 14 | 15 | 27 | 6.380 | 5.59 |
| 15 | 31 | 31 | 6.59 | 6.89 |
| 16 | 15 | 23 | 7.20 | 4.70 |

Table (4) Cardsd Sliver quality

2-3 Measurements : The carded sliver quality was examined according A.S.T.M. Standard . Neps /100 inch$^2$ and sliver eveness C.V.% were meesured .

3 Results and statistical analysis :

According to the construction details of experimental plan tables (2 and 3) the results of carded sliver quality have been determined as shown in table (4) the results were fed to a computer equipped with plotter HP , in order to get the rgression cofficients . The significance of tested variables and the response surface equations for carded sliver quality as shown in tables (5 and 6) . The obtained results plotted graphically . The first group of graphs fig(1 and 2) relates to neps and the second group Fig(3 and 4) relates to sliver eveness .

4-Discussion

4-1 Neps in carded web : The contoure of card web neps Fig (1 and 2) show that the cylinder to doffer setting : $X_1$ and cylinder to flats : $X_4$ have the majar effect on the nep count level as a main factors .
It is clear that as $x_1$ (cylinderto doffer setting) decreases the card web nep increases. This trend has been observed for both types of cottons G-75 and G-80. While the increment in

| Cotton Type sliver qual. | $Y_i = b_o + b_i \Sigma X_i + b_{ij} \Sigma X_{ij} + b_{ijk} \Sigma X_{ijk}$ | | | |
|---|---|---|---|---|
| | G -75 | | G -80 | |
| Coeffici. | Neps /100 in$^2$ | eveness (c.v.%) | Neps/100 in$^2$ | eveness (c.v.%) |
| $b_o$ | 14.124 | 6.495 | 21.3125 | 6.078125 |
| $b_1$ | -6.124 | 0.22125 | -4.8125 | 0.180625 |
| $b_2$ | -0.874 | -0.460 | 0.6875 | 0.186875 |
| $b_3$ | 0.124 | 0.01125 | 1.1875 | -0.144375 |
| $b_4$ | 4.375 | 0.1425 | 5.9375 | 0.650625 |
| $b_{12}$ | 3.8375 | 0.101 | 5.8125 | 0.144375 |
| $b_{13}$ | 0.625 | -0.142 | -3.1875 | -0.336875 |
| $b_{14}$ | -1.875 | -0.041 | 1.3125 | 0.335625 |
| $b_{23}$ | -1.125 | 0.016 | -2.1875 | -0.013125 |
| $b_{24}$ | -0.625 | 0.297 | 1.0625 | -0.100625 |
| $b_{34}$ | -1.125 | -0.123 | -2.4375 | -0.144375 |
| $b_{123}$ | 1.375 | -0.197 | -2.3125 | -0.145625 |
| $b_{124}$ | 3.125 | 0.158 | 2.6875 | 0.294375 |
| $b_{134}$ | -1.125 | 0.097 | -1.3125 | -0.294375 |
| $b_{234}$ | -2.375 | -0.383 | -4.5625 | 0.176875 |
| $b_{1234}$ | -0.375 | 0.187 | -1.1875 | -0.358125 |

Table (5) Response surface equations

$x_4$ (cylinder to flats setting) from 0.010 to 0.014 inch results in increment in neps.

From the above discussions the effect of $x_1$ and $x_4$ settings on card web neps can be explained as followintg : The fibre transfer Coefflcient from cylinder to doffer reduces as the setting between them increases , and Consequently the revolutions of the carded fibers on the cylinder surface increases , and thus the probability of neps removal between cylinder and flats in the main carding zone increases on the other hand , as $X_4$ setting increases the interaction between cotton fibers and wires in the main carding zone decreases and consequently , the probability of neps removal decreases.

In addition of the significant effect of $X_1$ (cylinder to doffer) and $X_4$ (cylinder to flats) settings at (99% and 95%), the effect of two factor interactions was determined as shown in table (6). It is clear that $X_1 X_2$ affects card web neps whatever the type of cotton fibers.

| Material sliver quality | Mean Squares G-75 Neps/100 in$^2$ | G-75 C.V.% | G-80 Neps/100 in$^2$ | G-80 C.V.% |
|---|---|---|---|---|
| i-Main effects | | | | |
| $x_1$ | 2.34*** | 0.0031*** | 1.45* | 0.002 |
| $x_2$ | 0.048 | 0.013 | 0.0295 | 0.0022 |
| $x_3$ | 0.00096*** | 0.0000079 | 0.08814** | 0.0013** |
| $x_4$ | 1.197 | 0.0013 | 2.2 | 0.0265 |
| ii-Two interactions | | | | |
| $x_1x_2$ | 0.92** | 0.00064*** | 2.11** | 0.0013* |
| $x_1x_3$ | 0.0244 | 0.082 | 0.64 | 0.0071** |
| $x_1x_4$ | 0.22 | 0.00011 | 0.108 | 0.007 |
| $x_2x_3$ | 0.079 | 0.000016** | 0.3 | 0.00017 |
| $x_2x_4$ | 0.0244 | 0.0055 | 0.071 | 0.00063 |
| $x_3x_4$ | 0.079 | 0.00095 | 0.37 | 0.0013 |

Tabl (6) Analysis of variance

*** Significant at 99%
** Significant at 95%
* Significant at 90%

## 4.2 Silver eveness.

From the previous work (3,4,5) they found that the silver irregularity was affected by the variation in the fed sheet , cylinder speed , setting to doffer or flats and the type and state of teethes in the flat and cylinderr covers (6).

The effect of carding m/c settings on silver eveness (c.v.%) represented graphically as shown in figs( 3 and 4).

The experimental results indicate that a deterioration of silver eveness accompaned with the increase of setting $X_1$ : cylinder to deffer as well as $X_4$ : cylinder to flats while the dishaplate -taker - in Setting ($X_3$) does not show any change in sliver regularity (C.V %) . On the other hand, it is obvious that a closer setting between taker-in and cylinder produce card sliver with higher C.V.% .
Also, it can be stated that the present experimentation, for material procesed and m/c used a wide setting of taker-in-cylinder ($X_2$), narrow space of cylinder-flats ($X_4$) and too-narrow spacing between cylinder and doffer ($X_1$) leads to a better sliver uniformity.

On the other hand, the two factor interaction $X_1X_3$ , $X_1X_4$ as well as $X_2X_4$ affect significantly at (99)% , (95)% , and (95)% respectively on Card Sliver eveness.

## Conclusion:

From the above discusions the following conclusions can be drawn

1 - Card web neps:
* The most important factors which affect the Card web neps are that the setting between cylinder and doffer and cylinder and flats .
* The lower rate of neps is obtained by narrow setting of cylinder to flats and a wide setting of cylinder to doffer.
* The two factor interactions such as cylinder to doffer setting and taker-in to cylinder affect siggnificantly in carded web neps.
* Cotton fiber "G-80" show a higher rates of neps compared with those obtained for "G-75" .

2 - Sliver eveness:
* The Carded Sliver eveness deteriorates as the setting of cylinder to doffer and that of cylinder to flats increases.
* The closer setting between taker-in and cylinder produce even sliver while the dishplate setting to taker-in does not show any effect on sliver eveness
* The better sliver uniformity obtained as the discussed carding machine settings decreases in the direction of material flow.

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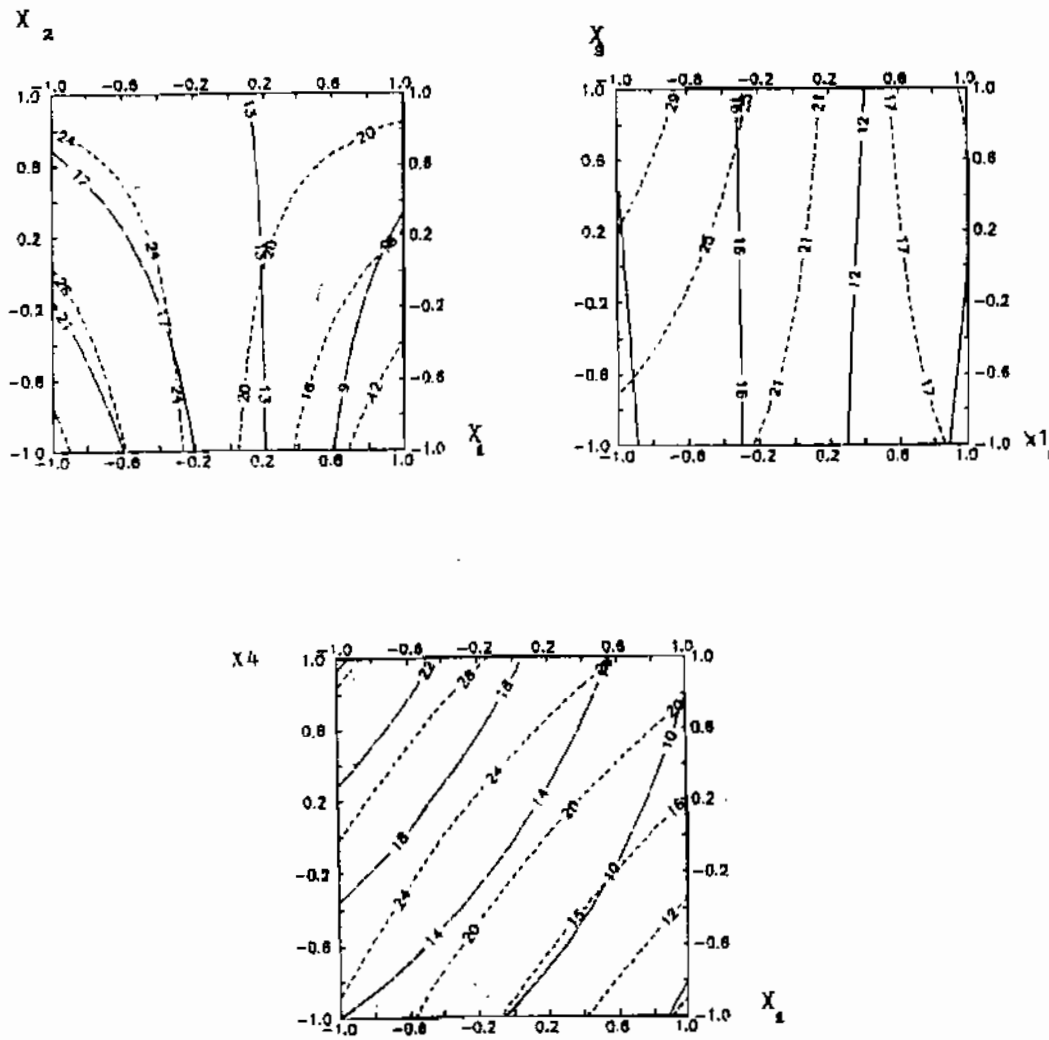


fig.(1) Contours for nep count

(——) Giza-75 (----) Giza-80

$X_1$ :Cylinder to doffer setting

$X_2$ :Taker-in to cylinder setting

$X_3$ :Dishplate to taker-in setting

$X_4$ :Cylinder to flats setting

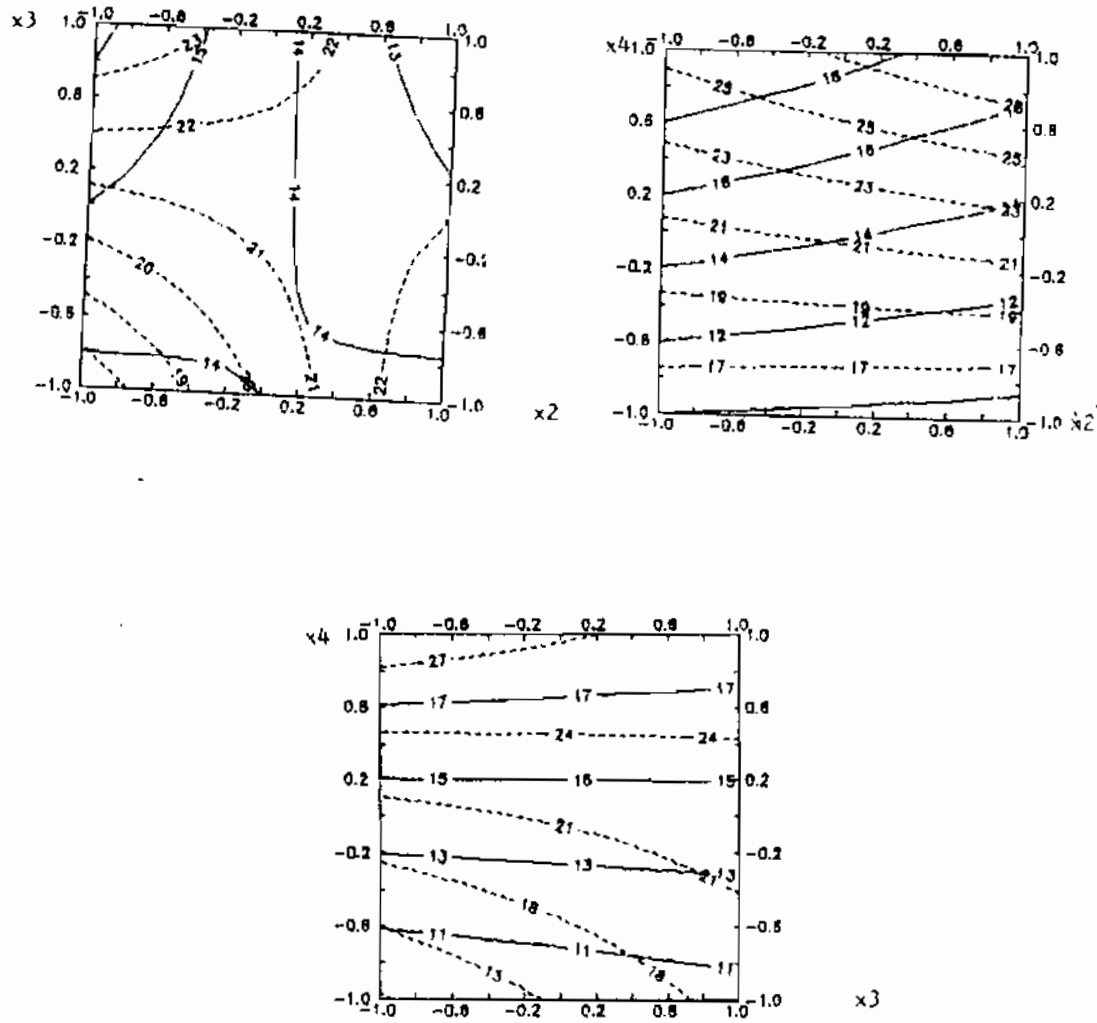


fig.(2) Contours for nep count

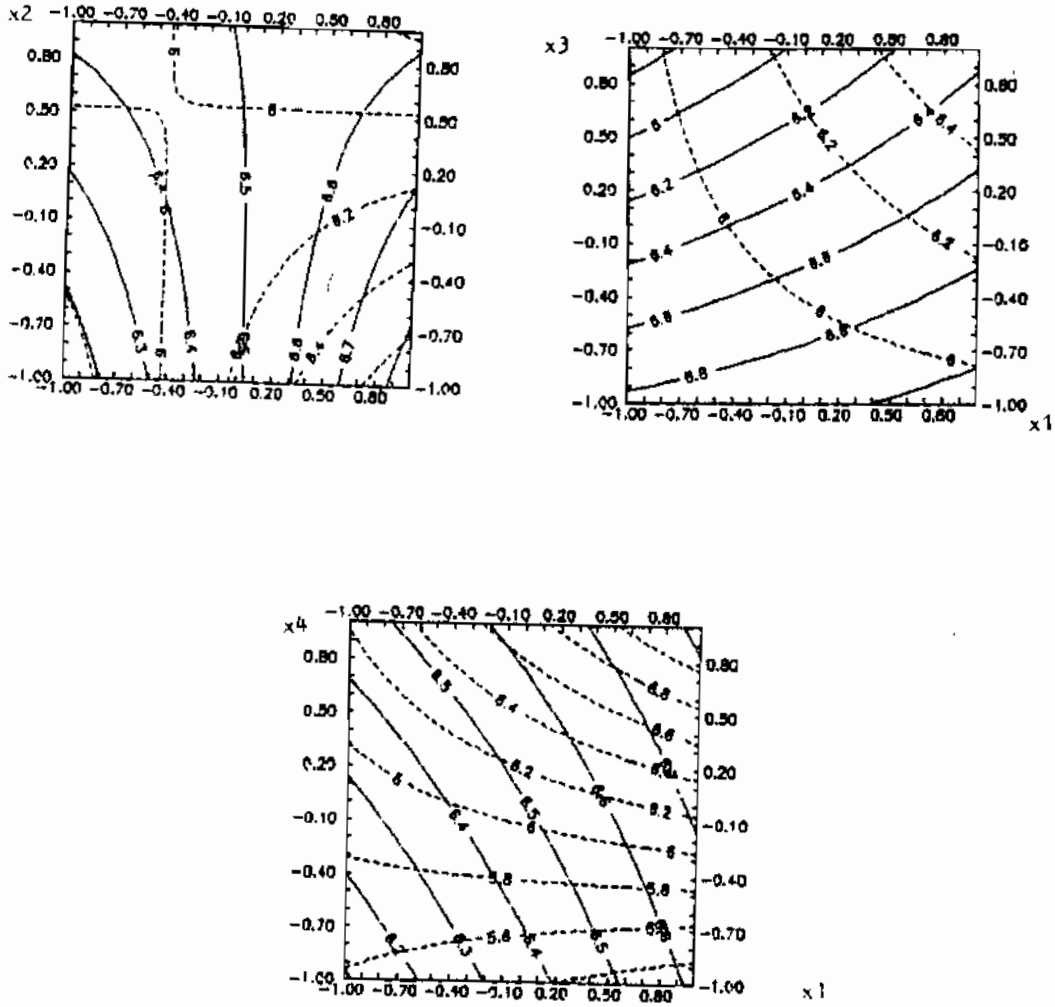


fig.(3) Contours for sliver eveness

(——) Giza-75 (----) Giza-80

$X_1$ :Cylinder to doffer setting

$X_2$ :Taker-in to cylinder setting

$X_3$ :Dishplate to taker-in setting

$X_4$ :Cylinder to flats setting

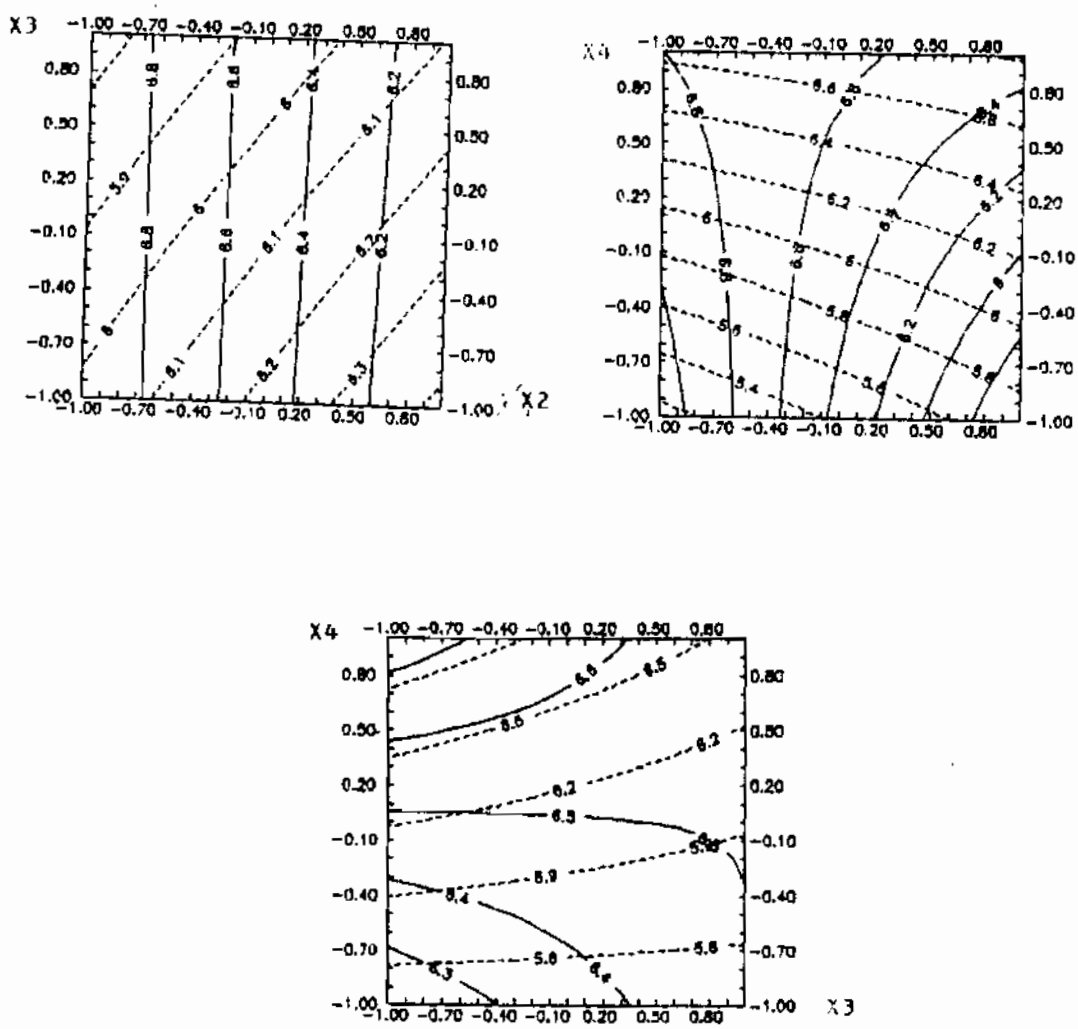


fig.(4) Contours for sliver eveness