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CALCULATION OF AREAS OF OVERLAPPING OF INKS OF RASTER ELEMENTS BY PRINTING FROM POINT TO POINT

Abstract: *In article the directions of moire's correction in multi-ink imprints by the method printing a point to a point. The algorithm of calculation of areas of overlapping of inks of square, rhombic and circular forms of raster elements by printing a point to a point, which with using the Nyberg-Neigebauer equations permission proceed directly to the calculation of the color coordinates of separate sections of the raster imprint and determine the exact tolerances for the accuracy of the combination of the imprints for certain types of printing products are proposed. The determine the error of separate technological process, which determination of combining the imprints of the refills and positioning on the given coordinate of the sheet.*

Keywords**:** *printing point to point, raster elements the areas of overlapping of inks, moire, calculation algorithm, accuracy, print quality.*

INTRODUCTION, PROBLEM STATEMENT

The most advanced and promising printing technology is point-to-point printing [1].

Modern triadic inks have relatively high transparency in transmission zones and high absorbency in absorption zones, so they can be used - while maintaining the tolerance to the combination - for printing point to point, that is, without change screen angle the raster systems.

Studies have shown that while maintaining fairly stringent combining requirements, the color images printed without turning the rasters slightly differ from the corresponding images obtained by the usual way with the change of the screen angle raster system.

When printing «point to point» there is a clearer separation of especially small details of the image, better allocation of individual colors.

The current solution to the problem of high-precision alignment was not possible. That's why the expediency change of screen angle the systems of individual inks has appeared, since in the main areas of the image (in colors and halves) applied coatings practically did not overlap of inks each other.

However, this allowed to increase tolerance for the combination of inks. Nevertheless, as practice has shown, the change of raster systems can not be done arbitrarily. The fact is that with any combination of the angular position of the raster

systems on the imprints there is no relation to imprints more or less noticeable color pattern or moire.

Moire of multi-ink printing is a parasitic pattern that occurs on the imprint as a result of the interference interaction of color separating images, combined with printing. The actual obserence of the moire is determined by its frequency and contrast, which depend on the color, tone and character of the picture on those or other parts of the image.

Such areas (as well as color images in general) differ in different moiregene - the possibility of a moire of a degree of visibility. When overlapping in the simplest case, two raster areas of one another, we get a new raster structure that contains both the total and the difference component of the output raster structures. The moire frequency is equal to the frequency difference of the overhead structures. The period of the more is determined by the mutual orientation of the raster lattice. For two linear rays, the monotonous changes of the moire period and its image are repeated 180°, for point orthogonal and hexagonal, respectively 90° and 60°. Moire is square and rosette.

Moire's correction also uses the irregular location of printed and non-transparent elements.

A point-to-point printing method is possible provided that models of prepress and press machines are introduced in which the color matching is carried out by the computer and processed automatically with the precision of the lines per inch [2].

Taking into account the rapid development of computer control systems and their implementation in polygraphic production, consideration and development of this method of correction of moire can be considered actual and timely.

PROBLEM STATEMENT

When printing from raster offset forms, where the thickness of the ink layer on the imprint is almost constant, the difference in the color of the individual parts of the image on the reproduction is due to the change in the raster elements area. These elements may be located at a distance from each other, or partially or completely overlap each other. As a result of such placement of the raster elements of all three paints, the spatial displacement of their reflection with the formation of different colors passes (Fig. 1).

When calculating the coordinates of the color of such a imprint, it is necessary to know the constant values of the color coordinates of the single, binary and triple color systems and the color coordinates of the paper, as well as the values of the areas of the inregister of inks and combined raster elements of each ink.

MAIN ARTICLE

The color register is defined as the degree of accuracy of the overlapping of colors from sequential printing forms. In the case of poor combining, the transmission of the features of multi-color elements of the image and the sharpness of their contours deteriorates. Combination may be acceptable if the reciprocal movement of parts of images is below ½ constant raster.

In Fig. 2 shows a graph of the dependency tolerances on the accuracy of the combination of colors on the imprints of the screen ruling by offset printing. In the

screen printing, an autotype raster with a 30-lpi (12 lpc) line is used, in flexography - 70 lpi (28 lpc), in which the precision of the combination of inks on the imprint should be respectively no greater than 0.416 mm and 0.178 mm.

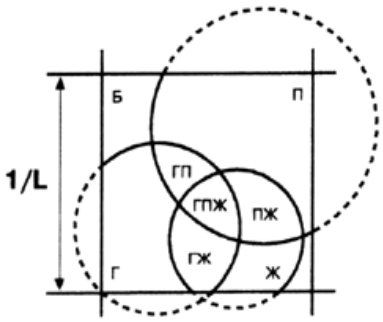

Fig. 1. *Eight basic colors of the triad autotype synthesis per unit area of imprint [1]*

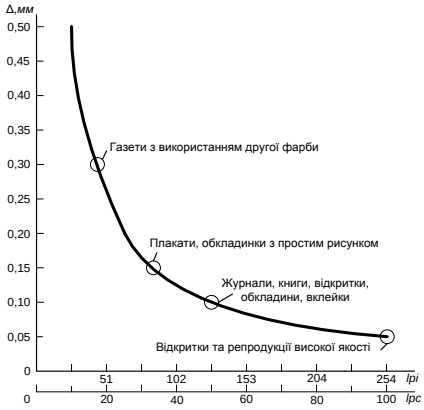

Fig. 2. *Dependency tolerances on accuracy the combination of inks on the imprint of the screen ruling by offset printing [7]*

The error of combining the imprints of the refills and positioning on the given coordinate of the sheet is the function of independent variables

$$\Delta_{pr.pos.} = f\left(\Delta_{pr.f.}, \Delta_{pr.m.}, \Delta_c\right), \quad \textbf{(1)}$$

where $\Delta_{pr.f.}$ – the error of the production of printing forms at the stage of prepress processes; $\Delta_{pr.m.}$ – the error of adjustment of the mechanisms of the printing machine and the errors associated with the properties of the paper; Δ_c - the error of the method of control and regulation of the accuracy of the combination of imprints.

The analysis of the accuracy of the manufacture of printing forms at the electronic assembly shows that today it is quite high (in the systems of the Suprasetter A52/A74 systems repeatability is) and the error can practically be neglected. Therefore, the first step in the transition to printing «point to point» is to increase the accuracy of the combination of color imprints, which provides the maximum overlapping of inks for the various shown in Fig. 3-5, forms and parameters of raster elements.

The algorithm for calculating the areas of overlaying of paints depending on the parameters of the combination of paints on individual coordinates *x, y* for adjacent raster elements of square form with parameters *a* and *b* are shown in Fig. 6.

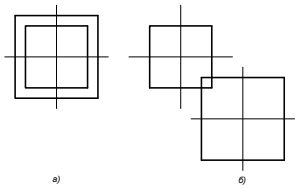

Fig. 3. *Scheme of arrangement of raster elements of square form: a) - precision; b) – displacement, authors'*

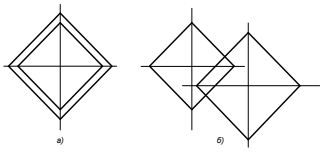

Fig. 4. *Scheme of arrangement of raster elements of rhombic form: a) - precision; b) – displacement, authors'*

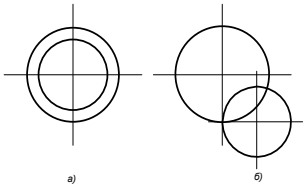

Fig. 5. *Scheme of arrangement of raster elements of circular form: a) - precision; b) – displacement, authors'*

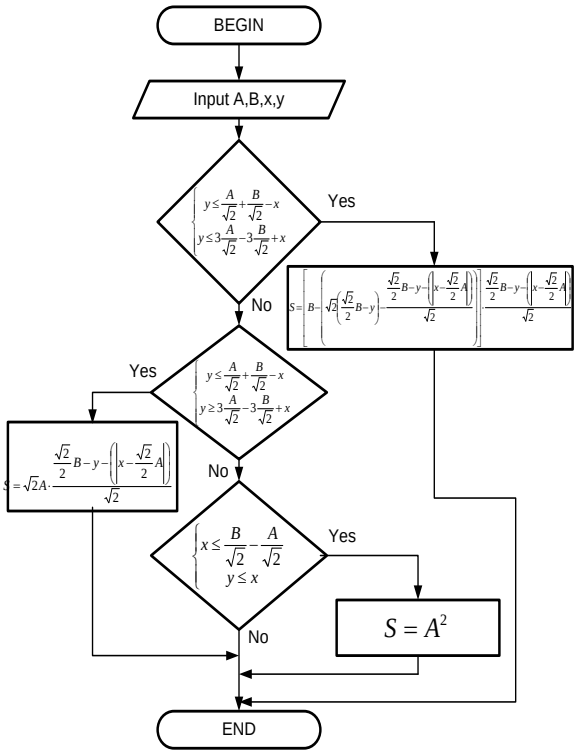

Fig. 6. *Algorithm for calculation of areas of overlaying of inks depending on the parameters of the combination of inks for raster elements of square form, authors'*

In Fig. 7 and Fig. 8 shows algorithms for calculating the areas of overlay of inks for raster elements of rhombsc (with output parameters *A, B*) and circular form (with output parameters *R1, R2*).

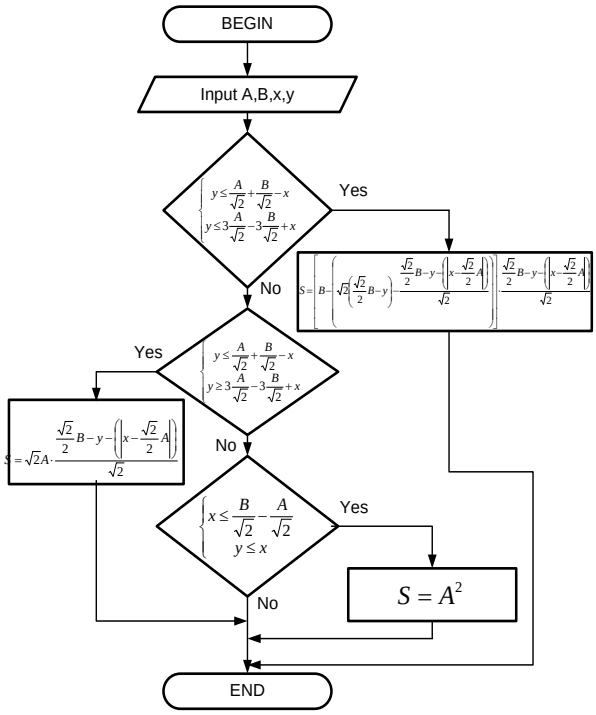

Fig. 7. *Algorithm for calculation of areas of overlaying of inks depending on the parameters of the combination of inks for raster elements of rhombic form, authors'*

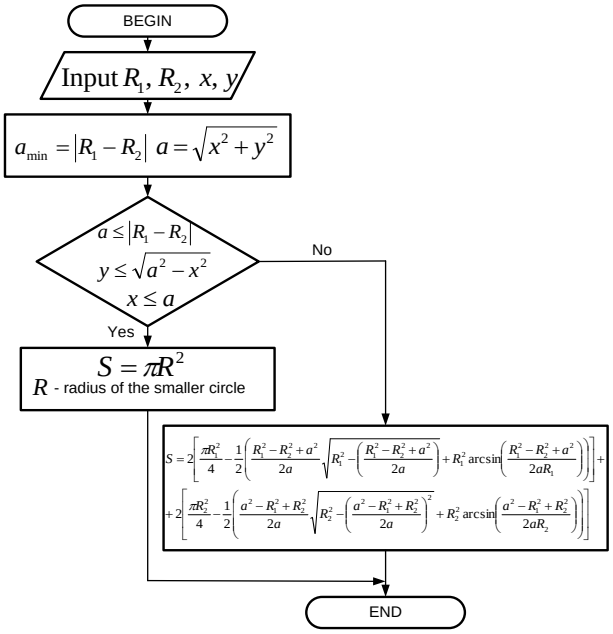

Fig. 8. *Algorithm for calculating the areas of overlaying of inks depending on the parameters of the combination of inks for raster elements of a circular form, authors'*

If the printing process provides a specified color coordinate value on the surface markings, then you can go directly to calculating the coordinates of the color of individual parts of the raster imprint using the Nyberg-Neigebauer equations [1].

Today, modern sheet-fed offset printing machines [3], the quality of printing on dimensional parameters is carried out by controlling the accuracy of reducing individual inks relative to the third (basic) ink and not directly controlling the parameters of the a combination of the imprints of the refills and the coordinates of their location on the sheets.

In order to eliminate this defect, the authors developed mathematical models for a new way of control the accuracy of alignment and positioning of imprints refills on sheets [4].

CONCLUSIONS

For impact assessment of precision color register on the quality of imprints, we propose mathematical models and algorithms for calculating areas of neighboring inks of square, rhombic and circular forms of raster elements with given dimensions of their sizes, and, therefore, using the Neuberg-Neigebauer equations, we proceed directly to the calculation of the color coordinates of separate sections of the raster imprint.

This will allow you to determine the exact tolerances for the accuracy of the combination of the imprints for certain types of printing products.

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