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AN ALGORITHM AND A PROGRAM FOR CONFIGURING RISOGRAPHIC PRINTING, TAKING INTO ACCOUNT THE PRINTING PROPERTIES OF PAPER

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The widespread use of risograph printing in printing houses requires an increase in the speed of equipment while maintaining the printing quality of the original layouts. The problem of risograph printing is not always obtaining high-quality images, since the risographs used in the standard driver (periodic, non-periodic) do not always allow you to get the printed image the same as in the original. This is reflected in the insufficiency of parameters such as image clarity and sharpness. Problems of poor quality of risograph printing can be solved by changing the settings of the risograph driver for the original layout with additional use of digital filtering and image rasterization. This will require the creation of additional image rasterization methods to improve the initial indicators of the original layout in contrast, clarity, and the correctness of the transmission of halftone images and will improve the quality of printed images, as well as ensure the efficiency of the printing process for a wide range of original layouts.

Keywords: risograph printing, original layout, rasterization, digital filtering, grayscale image

Introduction

The selection of paper for printing on a risograph requires the use of certain qualities of the paper medium, as well as subsequent evaluation of the prints obtained. To control the quality of the printed risograph impression obtained, it is advisable to conduct a comparative printing of the original layout on a laser printer, the printing technology of which has high quality indicators.

The Main Part

Paper is porous-capillary sheets consisting mainly of plant fibers, firmly interconnected by chemical hydrogen bonds. Thus, printed paper for books differs from writing paper, packaging paper and other types of paper in that it must not only have good consumer qualities, but also meet the specific requirements of the printing process. Along with paper, other types of paper are often used for making books – newspaper, cartographic, writing and others.

Paper is different for different printing methods and type of printed products.

Basic materials for making paper:

- wood pulp;
- cotton mass;
- fiber-free materials (fillers, etc.).

Classification of printed paper:

– according to the production method, when the significant feature is the content of the paper layer: uncoated and coated (table 1.1):

– according to the finishing the surface of the paper when the paper is cast or after additional processing: matte and glazed;

– according to the fibrous composition of the paper layer itself, depending on the raw material: pure cellulose papers and papers containing wood pulp. The wood pulp gives the paper a number of useful properties: the printing properties are improved, dimensional stability is maintained, and the density of the sheet decreases;

– according to the printing method: paper for high (in particular flexographic), offset and gravure printing. In addition, if necessary, paper intended for other printing methods is used. For example, flexography and screen printing do not impose special requirements on paper, and these methods can be printed on all papers designed for both high and offset printing. Offset papers are suitable for almost all printing methods, so they are also used in operational printing, namely in printing on laser and inkjet printers, as well as on a risograph;

– according to printed or other special properties, papers are divided into types, grades and brands, denoted by letters and numbers, sometimes by brand names, for example, with watermarks, colored paper, label paper, embossed [1].

Table 1.1. Characteristics of uncoated and coated papers

Uncoated paper	Coated paper
it has no coverage	it is coated with minerals
cheap	darling
loose surface	smooth surface
less shiny	more brilliant
absorbent	dense
poor surface quality	better surface quality
it has a fragile surface	It has a solid surface

The variety of printed products produced determines the existence of a considerable number of types of paper:

- offset (production of book products, magazines, flyers, newspaper printing);
- printing (books and brochures);
- newspaper (brochures, books, newspapers);
- coated (printing booklets, business cards, flyers, creating catalogs, magazines, book covers and brochures);
- writing (notebooks, notebooks,);
- design (business cards, invitations, representative products);
- barite paper (photo paper);
- packaging (durable kraft paper) [1].

Here are the characteristics of some types of paper:

- newsprint mainly consists of mechanical wood pulp (at least 85 %), which is why after a certain time it turns yellow and becomes brittle. Its density, which is determined by the mass of 1 m² in grams, ranges from 30 to 52 g/m²;

- printing paper number 1 (80-100 % bleached cellulose – vegetable fibers dissolved in water) of machine smoothness. It is intended for printing text and line-based visual materials;

- printing paper number 2 (25-50 % bleached pulp, up to 50 % wood pulp) machine smoothness, designed to reproduce textual and line-based visual materials;

- calendered paper for publications with halftone illustrations;

- book and magazine paper for offset printing (with a mixed structure, with wood particles). The weight ranges from 60 g/m² to 80 g/m². It is recommended for printing monochrome editions;

- offset paper (100 % bleached or sulphated cellulose) of machine smoothness is multipurpose and is used for printing newspapers, magazines, books, textbooks, etc. The paper density usually ranges from 60 g/m² to 220 g/m². Offset paper can be made with partial mechanical grinding and does not contain wood pulp. A distinctive feature of offset paper is its resistance to a moisturizing solution – this is achieved by an increased degree of sizing. There are many varieties of offset paper, among which there are calendered and super-calendered varieties;

- coated paper consists of a base layer coated on one or both sides with a chalk layer, which gives it increased brightness and smoothness.

To obtain printed products of optimal quality, it is important to take into account various factors, namely: the correct choice of consumables and prepress processes corresponding to this parameter.

The right choice of paper is determined by the type of publication: textile fibers are stronger than wood fibers, but, on the other hand, paper with a higher proportion of

wood pulp is much cheaper. Choosing paper obtained from waste paper, you can save significantly, but this is justified only if the consumer uses the publication for a relatively short time, since the recycled fibers do not have sufficient length for a strong bond [2].

There are also groups of indicators of the properties of printed paper:

- composition;
- dimensional and weight indicators;
- external characteristics;
- mechanical properties;
- surface character and deformation properties;
- porosity, wettability and absorbency;
- optical properties.

To ensure high quality of printed products, printed paper must have a certain set of properties, such as smoothness, softness, stiffness, dustiness. However, during risograph printing on hard papers, indistinct reproduction occurs, as well as hard papers lead to mechanical damage to the mesh of the mold cylinder of the risograph. The paper used for risograph printing must have the ability to perceive the ink and hold it on its surface. This is ensured by the ability of the paper to be wetted with paint, as well as absorb it into the pores. The absorbency of the paper is especially important when printing with paints used in risography, since the ink is fixed on the impression due to its absorption into the pores of the paper. Only in this case, the paint is fixed on the impression and dries. The absorbency of the paper depends on the type of fiber mass, porosity of the paper, filler, composition and type of sizing, as well as the physical properties of the absorbent paint components [4].

To characterize the absorbency of paper, a number of methods have been proposed based on measuring the rate of absorption of solvents or measuring the amount of ink retained by paper. Being in a humid atmosphere, the paper absorbs water. In this case, the cellulose fibers swell, as a result of which the paper sheet deforms when moistened. Deformation of the sheet can lead to a mismatch of colors in multicolored printing. Therefore, an important technological property is the deformation of the paper during humidification. The considered paper properties are also determined using special devices. The optical properties of the paper determine the appearance of the printed product and the image quality. Optical properties include opacity, whiteness, color and gloss of the paper [3].

The paper must be light-proof so that the image printed on the reverse side does not shine through. Therefore, transparent papers can only be printed on one side. Light transmission decreases with increasing paper thickness and the introduction of fillers.

The high whiteness of the paper provides a sharp, contrasting image perception. Whiteness is ensured by the selection of the appropriate fibrous material, bleaching of the semi-finished product, the introduction

of fillers and dyes. The paper is usually white in color, but colored paper grades are also used in offices.

The surface of the paper can be matte or shiny, which affects the appearance and quality of printed products. The optical properties of paper can be tested on visual cameras or other devices that measure transmittance, reflection, or optical density with high accuracy.

The adjustment of the original layout for risograph printing in terms of clarity, sharpness, and noise is carried out by using standard filters according to the scheme (Figure 1) and using specialized filters in accordance with the scheme (Figure 2). As a result of image processing of the original layouts, the light points of the image contours are illuminated and the dark ones are darkened, which improves the clarity of the image contour. To eliminate the complex of disadvantages for the original layout, it is necessary to use two types of filters (standard and specialized) [4].

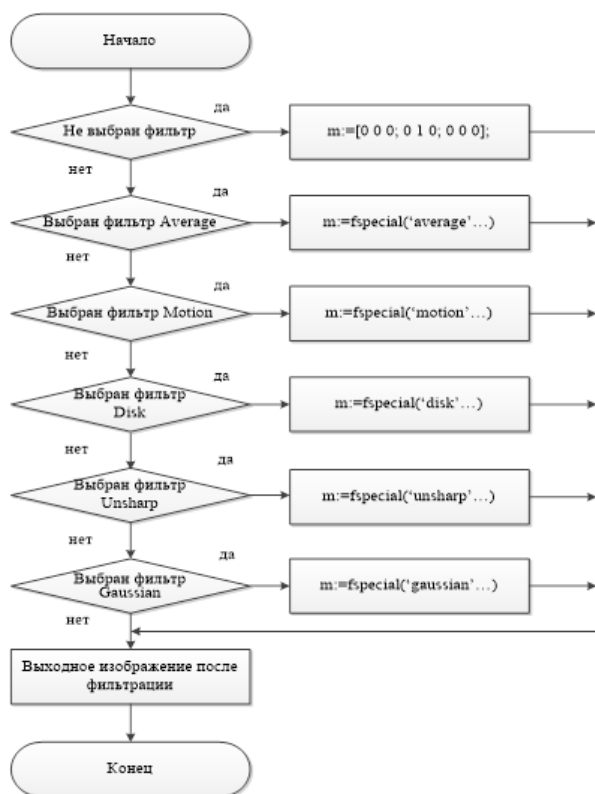


Figure 1. Block diagram of the algorithm for applying a standard filter

It has been experimentally revealed that obtaining a high-quality impression of a digital image on a risograph is often hindered by defects in contrast and clarity. It is also necessary to adjust the brightness alignment of the image in accordance with the flowchart (Figure 3).

To do this, the software provides two tools: manual and automatic brightness correction. The automatic brightness correction function is enabled by checking the box in the optimal brightness program.

The first step of the automatic brightness correction algorithm is to calculate the average brightness of the image points. This brightness is compared with the optimal brightness. The brightness of 127 units is accepted as optimal. If the brightness of the image is higher than the optimal brightness, then the difference between them is subtracted from the brightness of each point in the image, except for the black dots. Otherwise, the difference between the average brightness of the image and the optimal brightness is added to the brightness of each point in the images, except for the white dots.

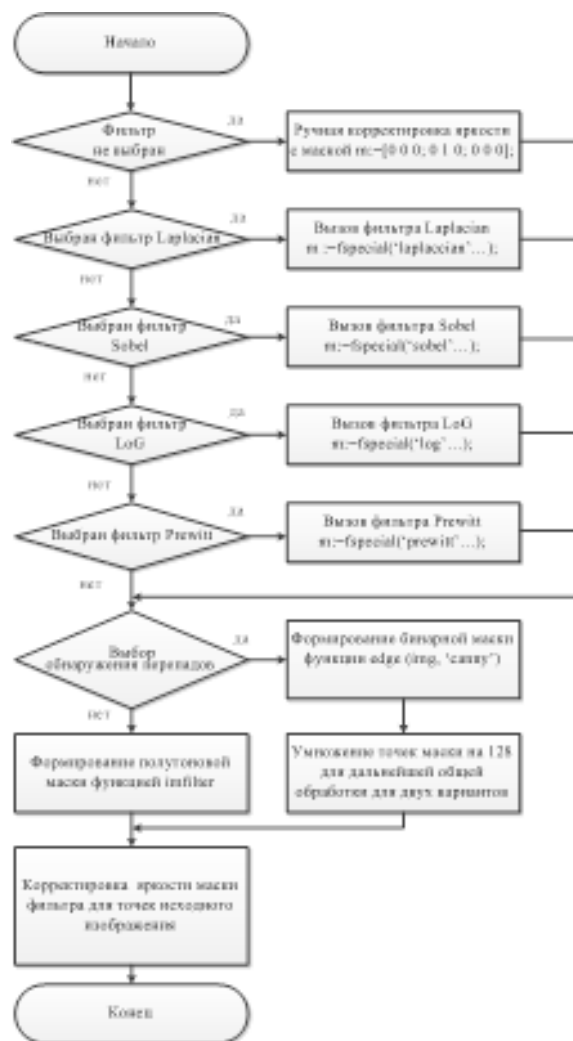


Figure 2. Block diagram of the algorithm for applying a specialized filter

To adjust the contrast of the original layout image, the software product is controlled based on the Adjust Contrast tool. The diagram of the dialog box is shown in Figure 4.

After launching the Adjust Contrast tool, a window opens with an image histogram. It shows ranges of image and display data. The range of image data conveys the existing coverage of the intensity values of the elements.

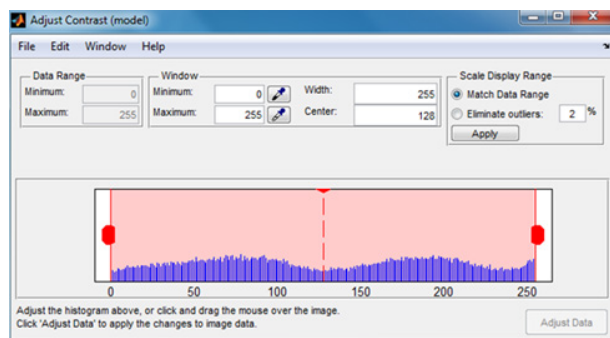


Figure 4. Adjust Contrast tool dialog box

The display range provides information about the maximum possible coverage of the original layout image. The histogram of the original layout is presented in uint8 format in the dynamic range from 0 to 255. There is a red rectangular area above the histogram, which adjusts the contrast of the original.

The Adjust Contrast tool application improves the image without changing the pixel values. The `imadjust` function is used to change the intensity values.

The next step in improving the quality of risographic printing is the additional use of adaptive image rasterization [4].

Conclusions

Algorithms for the automated application of combined filtering have been developed, including primary processing of the original image by linear filtration and secondary processing by nonlinear filtration; operation of linear filters; operation of nonlinear filters; brightness and contrast settings. Based on the obtained algorithms, a program for forming the print profile of the original layout for the risograph has been developed.

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ЮДЕНКОВ В.С., СУЛИМ П.Е.

АЛГОРИТМ И ПРОГРАММА НАСТРОЙКИ РИЗОГРАФИЧЕСКОЙ ПЕЧАТИ С УЧЕТОМ ПЕЧАТНЫХ СВОЙСТВ БУМАГИ

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Широкое применение ризографической печати в типографиях требует повышения быстродействия оборудования с соблюдением качества печати исходных оригинал-макетов. Проблемой ризографической печати является получение не всегда качественных изображений, так как используемые в штатном драйвере ризографа два типа растривания (периодический, непериодический) не всегда позволяют получить напечатанное изображение таким, как в оригинале. Это выражается в недостаточности таких параметров, как четкость и резкость изображения. В то же время проблемы низкого качества ризографической печати можно решить путем изменения настроек драйвера ризографа для оригинал-макета с дополнительным использованием цифровой фильтрации и растриванием изображения. Это потребует создания дополнительных способов растривания изображения для улучшения исходных показателей оригинал-макета по контрастности, четкости, корректности передачи полутоновых изображений и позволит повысить качество печатных изображений, а также обеспечить эффективность печатного процесса для широкого круга оригинал-макетов.

Ключевые слова: ризографическая печать, оригинал-макет, растривание, цифровая фильтрация, полутоновое изображение



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