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Analysis of raster imprints parameters on the basis of models and experimental research

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Introduction

To represent graphical and text information by printing means, it is necessary to provide the high quality of an image that can lost during the preprint processes. It occurs during screening, production of printing plates and during printing itself due to different kinds of influences and distortions.

Therefore, to provide quality of the printed products, it is necessary to control quality of implementation of separate technological operations and printing, to assess the optical density of raster image, in particular. An assessment is carried out mainly on experimental basis by means of densitometers on the basis of which graphic specifications of tone transfer are built, and analysis, synthesis, and correction of an image are maintained.

Modern densitometers are devices that on the basis of measuring of intensity of the reflected or skipped light by certain algorithms determine optical density, relative area of the printed elements, their geometrical sizes, fineness, etc.

The producers of densitometers, for well-known reasons, do not present algorithms of calculation of separate parameters crucial for measurement accuracy that can be considerable. Therefore, it is a relevant task to compare simulation results on the basis of well-known expressions with experimental researches.

Problem Description

Develop structural scheme of a model for determining the integral and optical densities of raster tone, to design special full format testing printing form, and to compare the results of simulation and experiment on the basis of simulation modelling, printing and experimental densitometry measurements.

Methods

The calculation of the integral density of the imprint by expression in the semi-logarithmic scale and the values of the raster tone according to the positive function, their comparison with the results of experimental studies is inconvenient, so on the basis of these expressions a structural diagram of the model was developed to determine the integral density of the raster imprint and the bitmap in Matlab package Simulink (Figure 1).

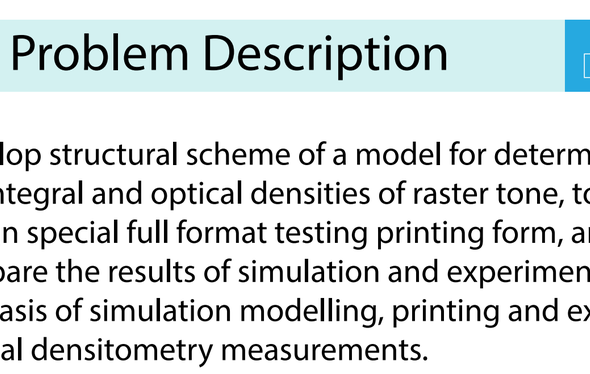

Figure 1

Structural diagram of integral density and raster tone model

Results

Adjusted the Constant block to the stream falling

F0 = 100% and the Ramp block to the reflected stream F according to expression. In block Fcn1 set the flux F/n where n = 1,15 - coefficient characterizing light scattering, which depends on the properties of paper and ink. The results of the simulation modelling of the integral density are presented in Figure 2.

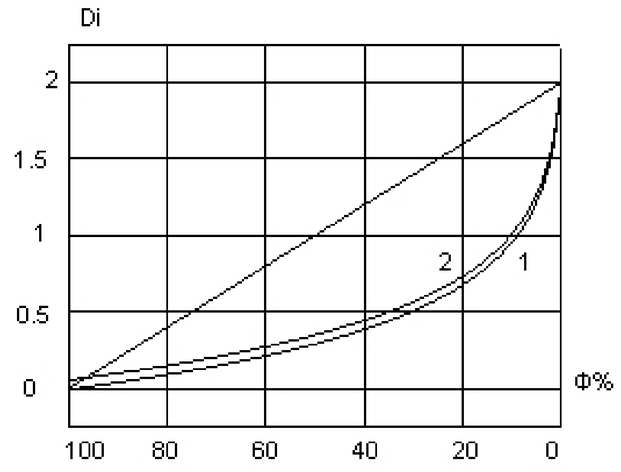

Figure 2

Characteristics of integral density
1 - calculated by expression (2), 2 - takes into account different influences

For comparison, the linear characteristic D0 is given in the figure 2. The peculiarities of features are their presentation on a semi-logarithmic scale. In addition, the beginning of the countdown of the reflected flux is reversed and begins with F = 100%, which is due to the method of measuring the integral density by the reflected light fluxes from the raster field of the raster scale of the print in which the image is formed in black. The designed characteristic is a rather non-linear curve, which is caused by logarithmic transformation. The second characteristic takes into account different influences, for example, the paper's optical density or ink properties, which are higher than of the previous one. In order to evaluate the properties of the integral density objectively, it is suggested to determine its deviation from the previous one

The results of the deviation of the integral density under the influence of the effects are presented in Figure 3.

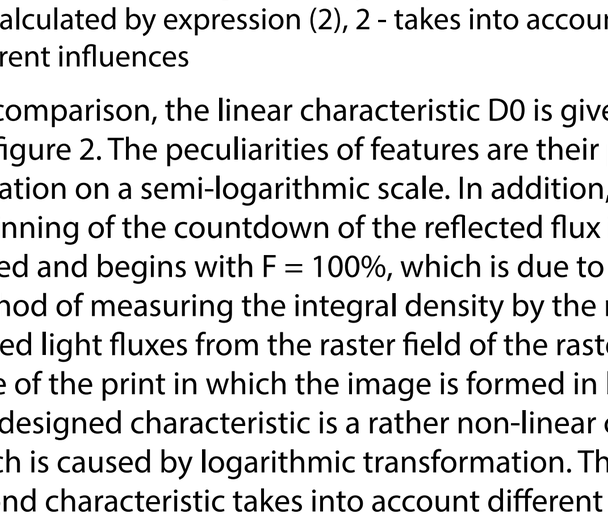

Figure 3

Deviation of integral density under the action of different influences

Discussion / Conclusion

Densitometers do not directly measure optical density, the degree of coverage of raster scales, and other parameters, but determine them by one or another, in most unknown algorithms, on which the accuracy of measurement depends.

The models of integral (average) density are presented on a semi-logarithmic scale, and the values of the raster tone of the positive, used in densitometers operating in reflected light, and the relationships between them, have been justified. The structural scheme of the model is developed to determine the integral density of raster scales of the imprint, raster tone in percentage, optical density of scales on the basis of the measured optical density of the solid area, which calculate and construct their characteristics.

The simulation results are presented in the form of characteristics for different parameters.

For the experimental research of the simulation results, a special proof plate with wide strips - with raster scales - has been developed to ensure adequate experimental research.

The results of the measurements of the optical density of the scales and the results of the measurements have been summarized in the table, on the basis of which it has been concluded that an increase in the thickness of the ink supply significantly affects the optical density of the scales. On the middle tones, the absolute difference in optical densities is in the range 0.1-0.2, and on the dark tones it is 0.2-0.25. The optical density of the raster scales obtained on the models is quite similar to the results of experimental studies and practically does not depend on the thickness of the ink layer.

The absolute difference of optical densities is in the range from 0.01 to 0.14, which corresponds to the tolerance of the optical densities of raster scales for chalked paper ± 0.15, which ensures the accuracy of modelling.

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