

ABSTRACTS

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ALGORITHM OF THE QUALITY EVALUATION SIMULATION MODEL OF DESCENT INSTALLATIONS

V. M. Senkivskiy, I. V. Pikh, O. V. Lytovchenko, T. S. Holubnyk, Yu. I. Petriv

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
senk.vm@gmail.com

Research methodology. In the scientific work we have used the methods of system and matrix analysis, the graphic theory for the selection and presentation of the formalizing relations between factors influencing the implementation process of book editions installation descents, the theory of hierarchical systems – for modeling of the priority of the factors influencing the processes under research; the methods of set theory to create a universal term set of linguistic variables; the fuzzy logic techniques for evaluating the quality of the implementation process of descent installations.

Results. An algorithm for calculating of the integral index of descent installations quality has been found. The simulation model has been constructed in the form of program interface which provides management capabilities and options of its functioning. The projected book quality has been provided with additional information concerning the essence of the technical and technological factors and material characteristics led to the expected rate.

Novelty. The concept of prediction quality publishing and printing processes of creating simulation models forecasting the process control of the book editions descent installations quality has obtained its further development, depending on the values of the input parameters given by the universal term-set and designed membership functions.

The practical significance. The simulation model based on this algorithm enables the management process of obtaining predictable results depending on the values of the input parameters of technical and technological factors and material characteristics led to the expected rate.

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THE VISUAL FUNCTION SCREENING DIAGNOSTICS INFORMATION SYSTEM

O. H. Khamula, M. R. Yatsiv

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
khog@yandex.ru

Research methodology. To create the «Screening Diagnosis» information system there have been used the modern software for making multimedia publications and flash-programming with writing application code.

Results. As a result of this work the information system with flash-programming has been created, which allows further development of interactive multimedia edition with the possibility of diagnosing visual function in online mode, while the system makes it possible to store the data and evaluate visual function changes over time. This work has both theoretical and practical value for the inclusive education exploring different visual perception of information deviations.

Novelty. This system is designed on the basis of the already existing systems, thus it is interactive and has a modern approach to the diagnosis. In future it may be modified by changing the elements used in the diagnosis.

The practical significance. This information system is certificated for other available programs, it can be completed with the existing foreign or domestic programs. It can be also used as appropriate facilities of inclusive education and at home.

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**METHOD OF AN EXPERT SURVEY TO IDENTIFY
THE INFORMATION SECURITY FACTORS FOR MOBILE DEVICES**

Yu. F. Petyak

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
yuriy.petyak@gmail.com

Research methodology. The paper has analyzed modern techniques of expert surveys in the field of data protection. By means of the classification method there have been formulated the main requirements for the design method of expert surveys. By analyzing existing methodologies for surveys and systematization of approaches to solve the problem, the organizational guidelines of expert surveys have been proposed. Based on the system analysis method, the factors of information security for mobile devices have been identified.

Results. According to the information technologies evolution, providing of the information security of mobile devices will be the main short-term objective. This requires establishing of the effective tools for rapid detection and blocking of hidden and unknown attacks on mobile devices. It is necessary to identify the main risk factors of information security for mobile devices. One of the methods determining the data protection factors for mobile devices may be an expert survey of specialists in this field together with the development of appropriate recommendations for accurate determination of the information security factors for mobile devices.

Novelty. The paper has proposed some organizational guidelines for conducting collective interviews with experts in absentia by means of questionnaires, and evaluation factors of information security in the form of fuzzy sets to determine the degree of their impact on the quality of data protection for mobile devices.

The practical significance. The main requirements for the survey conducting procedures have been distinguished, and the questionnaire forms and survey questions have been formed. The complex method of determining of the expert competence level and the minimum required expert group number has been proposed.

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**ESTIMATION AND IMPROVEMENT OF THE SAFETY
OF PHOTOELECTRICAL PROTECTIVE DEVICES
OF ONE-KNIFE PAPER CUTTING MACHINES**

R. V. Kazmirovych, O. R. Kazmirovych

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
kazmol@yandex.ru

Research methodology. The model of the safety of photoelectrical protective devices (PPD) with applied patterns reflecting the Markov processes which describe the random process of transition from working condition to emergency one and may describe the work of elements at time has been offered.

Results. The theoretical analysis of the PPD reliability has been conducted, the results being the calculation figures for estimation of the PPD reliability in a real control system. The empirical diagrams of the interval distribution between the PPD control cycles for the one-knife paper-cutting machines with a number programming control (NPC) have been constructed.

Novelty. The mathematical model of the PPD safety with embedded systems of a periodical control in perfect functioning in the form of graph transition has been

offered. The solution of differential equations of the PPD finding probability in working condition at any moment of time has been formulated and got. It has been confirmed that the distribution of time intervals between the control cycles caused by a random stream of cutting cycles is characteristic for the exponential law.

The practical significance. The use of multi-ray PPD with embedded devices of periodical control essentially improves the safety exploitation of one-knife paper-cutting machines (OKPCM) with NPC. The scheme sample of a multi-ray PPD with periodical control of its safety functioning has been presented, being simple in making and exploitation. Different national laboratory samples of multi-ray PPDs have been used at the laboratory and practical studies during the educational process.

UDC 655.218:778.182+655.027

THE ACCURACY OF THE AREA REPRODUCTION OF SQUARE DOTS IN THE DISCRETE FORMATION

M. M. Logoyda

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
Logoyda47@ukr.net

Research methodology. To determine the fidelity square raster element formed by a sequence of lines of different lengths in a raster cell, there have been made the following assumptions: the print raster conversion is a two-dimensional spatial sampling carrier tone in a raster image, a square raster element forming scanning unit is a sequence of continuous lines (stripes) of different lengths, there is a regular symmetrical arrangement sequence of lines on two coordinates, a raster cell contains an integer strips.

Results. The fidelity square raster element with the discrete formation depends on the area of screen elements. The largest absolute error in size screen elements are in the shadows and is 4., and the smallest in the range light is 1. The largest relative error is on light and the tone reproduction range is 25%, which in turn does not meet the regulatory requirements for the book and magazine quality production. Therefore, the value of the given error differs from 6.25% in the shadows, to 25% in light range.

Novelty. This article has first calculated the absolute and relative error resulted in a discrete area of screen elements forming the square on a light, medium range tone reproduction and shadows

The practical significance. The problem of determining of the accuracy of the circular dots area reproduction, formed by different line lengths in sequence has been explored.

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OPTIMIZATION OF THE PROCESS PARAMETERS FOR SCREEN PRINTING ON THE OXYBIODEGRADABLE FILMS

V. O. Korotka, K. F. Bazyliuk, R. S. Zatserkovna

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
viktoria.korotka@gmail.com

Research methodology. By the methods of statistical data analysis the effect of different screen printing parameters has been investigated, such as the size of the technological gap, inks viscosity, resolution mesh stencil and squeegee angle of inclination to estimate the ink layer abrasion resistance and the image resolution. The research has been carried out by analyzing the curve of random variables normal

distribution law, defining basic statistical parameters: maximum, minimum, average value; standard error of the mean; dispersion; asymmetry; kurtosis. Based on regression analysis the analytical expression of communication between the dependent and independent variables has been defined. Using correlation and nonlinear regression analysis the mathematical model of the ink layer abrasion resistance and the image resolution of the films samples have been built.

Results. The basic statistical parameters have been designed as a result of the studies, which allow to predict the distribution of these statistical series to be close to normal. A direct linear relationship has been discovered between the ink layer abrasion resistance and the technological gap magnitude, as well as between the image resolution and the resolution mesh stencil. As a result of the non-linear regression analysis the mathematical model of the ink layer abrasion resistance and image resolution has been built.

Novelty. As a result of the screen printing parameters optimization for the oxybiodegradable films, we have found out that the abrasion resistant image which withstands up to 3500 cycles with a resolution of 120 l/cm can be obtained by typing the following parameters: inks viscosity 65 Pa · s; technological gap size 6 mm; resolution mesh stencil 140 l/cm; squeegee angle of 75 °C.

The practical significance. The results of the screen printing process parameters optimization have great practical importance to obtain high-quality images on the oxybiodegradable films.

UDC 655.3.022

ANALYSIS OF THE ANILOX ROLLER SURFACE CONFIGURATION IN SHORT INKING SYSTEMS

O. L. Blahodir

National Technical University of Ukraine
«Kyiv Polytechnic Institute»,
37, Prosp. Peremohy, Kyiv, 03056, Ukraine
reprografy15@gmail.com

The subject of the research is the anilox roller surface configuration in short inking systems. The purpose of the paper is to present the key characteristics of anilox rollers, to analyze the influence of anilox rollers cells geometry on ink transfer process, to highlight the main cells configurations and its effective use.

The article has considered some aspects of anilox engraving technologies and explained the principles of anilox volume modeling. The author has dwelt on the history of anilox cells geometry in order to analyze its development.

The paper begins with a short discussion on the importance of anilox roller usage in inking systems and its impact on ink thickness on the substrate. The analysis of the previous publications has been made in the beginning of the article. Some remarks have been made on the development of anilox cell shapes that enables to improve ink transfer quality.

Then, the author has emphasized the main anilox roller characteristics and revealed their impact on the ink transfer process. Further on the author has highlighted and given a description of isolated and channeled anilox cells types and a brief analysis of the main anilox cells geometries of these types. It should be noted that the author has explained the difference between the isolated and channeled anilox cells types and peculiarities of their effective usage. The summary of anilox roller cells geometries analysis has been given as a classification due to such parameters of anilox geometry as: raster structure, cell shape and applicable area.

At the end the author has drawn the conclusion that the main characteristics defining the ink film thickness and uniformity are the anilox roller screen and volume.

The author has also admitted that the anilox cell shapes diversity both channeled and isolated enables to design an anilox roller to provide the best ink transfer quality for a specific purpose.

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FEATURES OF ECO-LABELING SYSTEMS

S. F. Havenko, O. D. Koniukhov
Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
kony2323@ukr.net

Research methodology. *The inquest of population regarding the definition of “environmentally safe products” and motivation of obtaining of a consumer attitude to the eco-labeled products and determination of quantitative indicators based on mathematical and statistical experimental data processing has been the aim of the survey by means of street interviews conducted on the basis of sociological research methods.*

Results. *The features of eco-labeling systems used in different countries have been determined. The international standard requirements concerning the eco-labeling have been shown and their characteristics have been given. The consumer attitude to environmentally safe products and the public awareness level in the area have been discovered on the basis of a sociological survey.*

Novelty. *The sequence of factors which influence the consumer choice of products, namely the information about ingredients, health benefits, price and availability of eco-labels have been determined. Their quantitative characteristics showing the population awareness level of eco-labeling practices have been also presented.*

The practical significance. *The results of sociological surveys are useful for manufacturers as they confirm the necessity of eco-labeling that is one of promising direction of a real label instrument serving as an effective way of increasing production loyalty.*

UDC 544.525.7

THERMOMETRIC STUDIES OF PHOTOPOLYMERIZABLE MATERIALS PHOTSENSITIVITY

V. V. Shybanov, I. Y. Marshalok
Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
vsh.shibanov@yandex.ua

Research methodology. *The article is devoted to kinetic study of photoinitiated radical polymerization of solid photopolymerizable materials (PPM). Light-sensitivity determination may be assigned by different principles, for example, densitometry, gravimetry, calorimetry. The paper proposes a method of the quasi-isothermal determining of thermal effect of PPM radical photopolymerization. Thermometric curves obtained under experimental conditions are adequate kinetic curves, which allows to determine the light-sensitivity of PPM.*

Results. *All obtained kinetic curves are of the same type. Polymerization consists of two unequally great periods: rapid stage from the beginning of the polymerization (lasting 10–40 % of the process time) and relatively slow second stage, which lasts for the rest of the time. On the kinetic curves it can mark a number of extreme points which determine the light-sensitivity of the PPM.*

In the article the light-sensitivity of a number of applicable printing materials has been established. Comparison of the results of light-sensitivity determination

by known gravimetric (gel fraction) method and the proposed thermometric method indicates a good correlation between them (correlation coefficient is 0,992–0,997), which proves the correctness of the use the proposed method.

Novelty. Thermometric method of determining of the photopolymerizable materials sensitivity is first proposed.

The practical significance. The proposed method can be applied to study the kinetics of the processes of photoinitiated radical polymerization of solid and liquid PPM. Application of this method tenfold reduces the duration of the researches.

UDC 539.62

THE COPPER AND LEAD FUSIONS INFLUENCE ON PHYSICAL MECHANIC PROPERTIES OF HIGH-DURABLE STAINLESS STEELS

O. V. Shyrokov, V. V. Shyrokov, Ya. O. Shakhbazov, O. I. Datsyi

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
vshyrokov@gmail.com

Research methodology. Modeling of the influence of the temperature factors and adsorption of active metals (copper and lead) on the mechanical properties of stainless steels has been conducted by means of the metallographic, electron and X-ray analyses of the structure (surface fracture). Mechanical tests of the definition of the characteristics of strength and ductility, fatigue trial on minicycle (pure bending) in the temperature range of 293 K ... 1350 without and in contact with air and spectral pure argon; magnetometric analysis have been also done.

Results. Based on the analysis of experimental data and calculations it has been found that this class of steels in the temperature range 500 ... 800 K inherent dynamic strain aging caused by dynamic blocking dislocation atoms of carbon and oxygen and less nitrogen.

There has been discovered the mixed impact of δ -ferrite content in embrittlement ability to melt. The minimum and maximum content of δ -ferrite (1 and 12 vol.%) has been defined. Embrittlement occurs at slightly lower temperatures than at intermediate concentrations of — 4 ... 6 vol.%. In the first case δ -ferrite structure is virtually nonexistent, except for certain substances in the martensitic colonies; and in the latter it is present in the form of individual grains. For intermediate concentrations of δ -ferrite the fines edge border martensitic or austenitic grain colonies and restricts access to melt them.

It has been found that the optimal content of δ -ferrite, which provides VTRMO minimizing the consequences must be between 4 ... 6 vol.%. Welded steel samples at embrittlement copper soldering have been destroyed in the heat-affected zone. The temperature range or degree of embrittlement does not depend on the method of soldering in this area. Embrittlement of welded samples in all cases occurs at temperatures of steel plasticity reducing (without soldering).

Novelty. For the first time the experiment has been conducted in a wide temperature range (293 ... 1350 K). The VNS55 steels have been tested for the deformation resistance and the effects of doping ratio of Cr/Ni on their high-temperature mechanical properties. For the first time it has been found that the VNS55 chromium-nickel steel gets embrittlement at temperature above 1173K by the influence of the copper and lead fusions resulting in a constant rate of deformation and tension during fatigue tests on minicycle (MTSV).

The practical significance. Based on the experimental results they have defined the temperature ranges of embrittlement by the copper and lead fusions for the VNS55

steels in the temperature range of 293 K ... 1350 with setting of the corresponding numerical values of the characteristics of strength, ductility and durability of steels in contact. The optimal structural phase and chemical composition of steels in terms of minimizing of the embrittlement action of copper have been found, being the basis for making recommendations for soldered-welded three-layer constructions with a metal collar filler.

The results are of practical importance in the design and calculation of critical fasteners, valves, choice of materials and other elements of the cellular structures that use or intended use of chromium-nickel steel, brazed or soldered them-welded joints.

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Z-SCAN RESEARCH OF SILVER NANOCOMPOSITES

M. V. Periv

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
periv-mv@i.ua

Research methodology. The experimental data of nonlinear refraction of silver nanoparticle composites using the standard Z-scan technique have been presented in the paper. It is based on the measurement of the intensity of the focused laser beam passed through the specimen moving along the beam as the last one. Nearby the focal point, where the power density of the laser beam reaches its maximal, the transmittance of the sample increases or decreases relatively to that in linear regime depending on the sign of nonlinearity.

Results. Nonlinear refraction and nonlinear absorption have been measured employing standard single beam Z-scan technique. It has been found that the colloids of silver nanoparticles of various sizes possess defocusing ability. Based on the general considerations, one can conclude of the thermal lens nature of the nonlinear refraction of silver nanoparticle composites.

Novelty. By the results of normalized transmission investigations in Z-scan regime it has been confirmed that Ag nanoparticles with the size of 14–18 nm after annealing of Li₂B₄O₇: Ag glasses in reduced atmosphere are located in thin near-surface layer and form the so-called interface region. This interface region changes the character of nonlinear refraction of Li₂B₄O₇: Ag glass from negative to positive, and significantly enhances its nonlinear properties due to plasmon resonance.

The practical significance. Silver nanoparticle composites can be used as efficient optical limiters which require high nonlinear refractive index materials.

UDC 316.5

HARD AND SOFT MATHEMATICAL MODELS AND THEIR APPLICATIONS

I. V. Ohirko, M. F. Yasinskyi, L. M. Yasinska-Damri

Ukrainian Academy of Printing,
19, Pidholosko St., Lviv, 79020, Ukraine
ogirko@ukr.net

Research methodology. One of the important scientific problems of natural history is the probed object conduct foresight problem solution in time and space on the basis of certain knowledge of its initial state. This problem is taken to find out some law which allows to define the object's future at any moment of time of $t > t_0$ with the time of t_0 in the point of space and of x_0 in the initial moment.

Results. Depending on the degree of the object complication this law can be

determined or probable, it can describe the object evolution in time only or in space only and can describe a spatial temporal evolution. Under the dynamic system they understand any object or process, for which a simple certain concept of state as some totality of values has been determined in this moment of time, and the law which describes time history (evolution) of the initial state has been set.

Novelty. *The mathematical model of the dynamic system is considered to be set if the system parameters have been introduced to determine its state simply, and the law of evolution has been detected.*

The practical significance. *Depending on the degree of approaching, different mathematical models can be put in accordance with the same system.*