

ABSTRACTS

UDC 004.04

DEVELOPMENT OF ALGORITHM OF REALIZATION OF FORECASTING PROCESS

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Research methodology. We have used Markov processes to investigate the forecasting process of the printing production whose advantage lies in the fact that it is enough to know only two-dimensional distribution laws to characterize them. We have used the methods of probability density distribution on the basis of a mathematical model, which is the first and second Kolmogorov equation to build the algorithm of forecasting of random processes.

Results. We have developed a functional scheme of the forecasting process of the printing technological process (DTP) on the basis of the research and their mathematical description. The suggested functional diagram within the analysis system allows increasing the level of recognition and identification of external negative factors acting in DTP.

Novelty. We have suggested the algorithms of forecasting system design as a functional scheme that enables to control negative random events in DTP based on the developed mathematical models of processing and control random events that negatively affect DTP.

Practical significance. The suggested methods of process organization of events forecasting enable the practical implementation within one cycle of the forecasting implementation, which can significantly increase the effectiveness of forecasting of printing processes.

UDC 004.02

ANALYSIS OF PROCESSES OF NEGATIVE IMPACT ON INFORMATION MANAGEMENT SYSTEMS BY FRAGMENTS OF PRINTING TECHNOLOGIES

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Research methodology. We have used the distribution function of Poisson to study the process of negative impact of the printing production on information systems, which makes it possible to optimize the process of analyzing each item, which may be an anomaly. We have considered the types of threats that may occur in the information system of the printing process management and types of attacks,

on the basis of using the mathematical logic, and in particular Hentsen output system that lets you create mathematical counter models to negative influences and attacks.

Results. We have suggested the methods for determining the threats and dangers on the basis of researches of a negative impact on the information system that may arise in the process and described the method of recovery after attacks.

Novelty. We have suggested the methods of mathematical modeling of control and system recovery after the exposure to attacks based on the mathematical description of the suggested methods and types of types of attacks on information systems management by fragments of the printing technologies.

Practical significance. Methods of identifying threats and dangers in the management systems by the fragments of printing technologies make it possible to realize the protection from negative influences that can significantly increase the overall effectiveness of the printing process control.

UDC 004.9+621.317+543

INFORMATION - ENERGY CONCEPT OF MEASURING SYSTEMS DESIGN BASED ON SRS EFFECT - PHOTONS SCATTERING

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Research methodology. We have used the IBC system analysis, information - energy interaction of laser beam with molecular structures and their environment and their quantum - photon activation.

Results. We have designed a structural block diagram of a laser photometer based on the SRS - effect as a means of controlling the technological environment of the management objects.

Novelty. We have used SRS effect - stimulated Raman scattering of photons for developing laser information - measuring systems that are emitted when exciting the molecular structure of the environment with a laser beam, respectively integral characteristics and parameters of which depend on changes in the beam structure.

Practical significance. The conducted analysis of methods of laser sensing of the environment chemical compounds solution has shown that the use of the concept (SRS) - stimulated Raman scattering of a laser beam is the basis for design of hardware and software IBC necessary for remote active study of the dynamics of solubility and interaction of compounds based on the evaluation of integral parameters (concentration, activity, heterogeneity) by laser method in dynamics. Accordingly, from this follows that the concentration of the solution is associated with the loss value of energy of scattered laser beam. With nonlinearity and the optical activity of the environment we have the amplification of the probe laser beam, indicating the specific processes in the object. For each chemical compound that is a part of the researched liquid medium there are the parameters that are associated with energy and information

characteristics of a laser beam and they can be indicators of the presence signs and condition thereof. In printing the suggested method of can be used for quality control of paper, chemicals, polymer films. Laser sensing method can also be used to enhance the activity of biological samples and liquid medicine in emergency situations and for rapid monitoring of the ecological state of technological systems.

UDC 655.3.028+004

DEVELOPMENT OF MODEL OF HIERARCHICAL SYSTEM FOR ENVIRONMENT AUTOMATIC TEMPERATURE CONTROL OF A CONVEYOR DRYER

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Research methodology. The system analysis and the theory of hierarchical systems have been used as the basis of strategies synthesis for coordinating management of the drying process.

Results. We have developed the concept of the formation of the thermodynamic spatial fields with optimization structure of using convective and radioactive heat transfer in which the radiation energy flow is formed by laser radiation of the corresponding range and power. The management strategy is defined by the hierarchical model of units of complex control objects.

Novelty. We have used a powerful infrared laser irradiation to create a highly concentrated high-directional thermal field, which increases the efficiency of the drying process in the area of the adhesive connection.

Practical significance. For the first time we have used the method of laser heating to form a high-energy thermodynamic potential in certain areas. Printing products are the basis of the drying process quality improvement and productivity.

UDC 681.3665

IMPACT ANALYSIS OF VARIATIONS OF INK-PRINTING SYSTEM PARAMETERS OF PARALLEL STRUCTURE ON ACCURACY OF MODULATED INK FLOWS TRANSFER

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Research methodology. Methodological base of the research makes the principle of balance ink flows in the ink-printing system. We have solved this problem

using the theory of signals to analyze ink flows modulated by a raster printing plate, a graph for the analysis of modulated ink flows, the theory of errors to determine the accuracy characteristics with variation of input parameters of the system.

Results. In this research we have worked out a mathematical model of transferring ink flows modulated by a raster printing plate for a given range of variation in tone reproduction parameters of a short ink-printing system of parallel structures. We have designed a graph and a block diagram of the system basing on which we have identified an analytical dependence of static system accuracy at a given range of tone reproduction with variation of parameters. We have presented the results of simulation modeling as precision characteristics for variation of input parameters of the system. It was established that the printing system of parallel structure is quite sensitive to variations in input parameters and does not fully ensure the technological requirements for uniformity of raster images coverage. The work has practical meaning.

Novelty. Scientific novelty of the results is that an analytical dependence of static covering accuracy of raster images on a specified range of tone reproduction with variation of parameters has been identified that contribute to the improvement and development of the structure and parameters of the system, and improve the quality of books.

Practical significance. We have established that static accuracy of a short ink-printing system of parallel structure of the seventh dimension largely depends on the tone reproduction range and in bright colors and shadows sample is $\pm 15\%$. The research results can help to choose the anilox roller capacity for a given image scene unit.

UDC 681.624

COMPUTER DETERMINATION OF THE OPTIMAL NUMBER OF INK PRINTING SYSTEM WORKING CYCLES FOR PREVIOUS INK FILLING

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Research methodology. For a problem condition evaluation of offset printing machines ink printing system time-to normal operating mode optimization we have used general scientific methods: analysis, comparison and synthesis. During research work performance of the ink printing system model build we have used methods of operational calculus, discrete conversion, automatic control theory and matrix theory. Researches have been conducted using a computer ink printing system simulation model in a Matlab-Simulink environment.

Results. An ink printing system mathematical model with serial structure of the virtual offset printing machine has been constructed. Ink printing system simulation model has been built in a Matlab-Simulink environment. The technology for number

of ink printing system cycles determination for previous ink filling has been proposed based on the conducted researches.

Novelty. Ink printing system mathematical model that takes into account oscillation cylinder and ink feeding unit operating modes has been developed. As a result of conducted researches an analytical expression to determine the optimum ink layer thickness on the form roller surface has been received. Integration of this expression in the ink printing system simulation model makes it possible to determine the optimal number of system cycles for it previous ink filling.

Practical significance. The proposed technology for ink printing system steady state achieve time reduction by the way of optimal working cycles number determination for it previous ink filling can be applied to ink printing systems with any structure. The obtained data of the working cycles number for ink printing system previous ink filling will be particularly important for workers who serve offset printing machines which are unequipped by respective systems of automatic control.

UDC 004.942

MODELLING OF DISEASES DISSEMINATION WITH MULTI-RESISTANT PATHOGENS

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Research methodology. The bases of the methodology of the study are the principles of digital simulation of the disease prevalence, based on knowledge of biology, medicine and mathematics. If the first two areas are related to the ways of infection, the clinical course and the treatment of diseases, the latter is the essence of modeling. Thus the tested population was divided into three groups: favorable to a disease, pathogen infected and treated effectively. Transitions of individuals between groups of observations are modeled in the form of digital equations that allows

proving mathematically the epidemiological parameters for diseases depending on the presence of the pathogen.

Results. The studies substantiate the mathematical model of tuberculosis in view of sensitivity and stability (multi-resistance) to pathogens. The model is considered basing on square lattice using the cellular automaton for different cases at different levels of observation multi-resistant tuberculosis pathogen.

Novelty. Scientific novelty of the research results is processing a mathematical model to assess the epidemiological situation of TB in the presence of sensitive and resistant (MDR) pathogen. The suggested mathematical model relates to different types of populations with regard to pathogen infection, presence of risk of disease and effective treatment of individuals that were observed.

Practical significance. The experience and the mathematical model of epidemiological assessment of tuberculosis prevalence are promising for use in the health care system at the stage of initial medical management (polyclinic units), as well as in specialized medical institutions (TB establishments) with an objective assessment and forecasting indicators of prevalence of the specified disease.

UDC 655.027

MODEL OF INK APPLICATION ON RASTER ELEMENTS OF RHOMBIC SHAPE

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Research methodology. We have applied topological methods of analysis, graph theory and mathematical modeling and computer simulation.

Results. The mathematical dependence of ink quantity on the surface of the screen elements in the case of stable and descending ink flow for a given range of raster tone reproduction has been received. The results of simulation modeling have been presented as inking characteristics which are nonlinear. At constant ink thickness the deviation of linearity characteristics depends on the range of tone reproduction and may be in the range of -12.54 to 12.14%.

Novelty. We have processed the model of inking of raster elements of rhombic shape at stable and descending ink thickness.

Practical significance. The data can be used for information technology as a source of inking characteristics and a model of raster element of rhombic shape.

UDC 655.28.022.2**ANALYSIS OF METHODS OF RASTER DOTS DESIGN
IN PREPRESS SYSTEMS**

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Research methodology. This paper uses the systematic analysis of technological parameters of raster scanning output devices and methods of halftone dots forming for a given resolution and increasing printing quality and effective means to implement them.

Results. The analysis of methods of imaging in modern prepress systems has been done by scanning with a laser beam that affects the printing quality directly. The imperfection of beam focusing and inappropriate form of a spot focused on the plane of the recording material, results in poor printing quality. It is shown that improving the printing quality is obtained by using laser dots of square shape.

Novelty. When using a circular laser beam of the exposition laser, the dot does not always correspond exactly to a square raster grid and therefore should be set with a margin. In addition, the energy of such laser dot decreases from the middle to the edges of it, so the exact position of the threshold energy level at which begins the plate exposition, is uncertain. You can solve these problems using square laser dots with uniform energy.

Practical significance. The use of square laser dots provides the specific resolution of printing products, the necessary frequency of scanning and the necessary product quality.

UDC 004.384+004.415.2**DIGITAL MODEL OF SHEET-CUTTING WEB PRESS
WITH DOUBLE-ENGINE ASYNCHRONOUS ELECTRIC DRIVE**

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Research methodology. To achieve the assigned objectives we have used the basic statements and methods of the control theory, discrete control systems theory, mathematical and computer simulation modeling methods. Software package Matlab Simulink has been used for computer models simulation of structural elements and sheet-cutting web press systems, processing and obtaining characteristic dependencies.

Results. A digital model of a sheet-cutting web press with double-engine asynchronous drive and information management system has been developed. An

appropriate simulator has been built in Matlab Simulink environment based on the models of electromechanical and tape leading systems of a sheet-cutting web press. As a result of the conducted research the effectiveness of a sheet-cutting web press with double-engine asynchronous drive system has been proved by increasing of precision of cutting operations and improving the drive dynamic characteristics.

Novelty. Digital mathematical models of tape leading and electromechanical systems have been built and a simulator for these presses research and dynamics analysis has been developed. The mathematical model of a sheet-cutting web press with double-engine asynchronous drive has been suggested.

Practical significance. The designed digital model is the base for program writing and construction of appropriate simulators in Matlab Simulink environment, which enable to carry out modeling and study of the processes occurring in electromechanical and tape leading systems of a sheet-cutting web presses in static state and dynamics, allow making predictions and recommendations regarding the required frequency of maintenance of individual presses. Regulators synthesis can be performed on the basis of the developed model and digital control systems of working parts of sheet-cutting presses can be designed.

UDC 621.327

PERFORMANCE CHARACTERISTICS OF PULSE-WIDTH POWER CONTROL OF FLUORESCENT LAMP

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Research methodology. The performance characteristics of pulse-width power control of fluorescent lamps with electronic ballast at its high-frequency operation have been obtained on the basis of the method of fundamental frequency resonant circuit analysis, using the nonlinear model of fluorescent lamp.

Results. A resonant inverter with different values of characteristic impedance as an output stage of fluorescent lamp electronic ballast has been considered. Nonlinear mathematic lamp model consists of a constant coefficient, a linear and exponential unit depending on its power. The dependencies of inverter pulses to lamp power characteristics have been studied. It is shown that the lamp power can be effectively controlled over a wide range by adjusting the duty-ratio. Maximum and minimum values of dead-time limits for ensuring zero-voltage switching of transistor switches have been obtained. It is shown that filament power variations during the lamp dimming operation are reasonable. Fluorescent lamp starting voltage throughout the power range has been obtained. Theoretical predictions are in good agreements with experimental measurements in 40 W electronic ballast-fluorescent lamp system.

Novelty. The scientific novelty of the results lies in the fact that there have been obtained the analytical connections between the parameters of a resonant inverter and the performance characteristics of pulse-width wide range power control of a fluorescent lamp. It is shown that all control characteristics essentially depend on the value of characteristic impedance of a resonant inverter. It is shown that control-to-power sensitivity characteristics vary in a small range that proves a good controllability of pulse-width control.

Practical significance. The obtained results may be a basis for designing of modern high frequency electronic ballasts with wide range power control of fluorescent lamps.

UDC 621.317.39 : 532.574.6

IMPROVING THE ACCURACY OF COMPUTER SYSTEMS FOR PROTECTION OF IMPORTANT OBJECTS

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Research methodology. The methodological bases of research are principles of the development of new methods and means to improve the accuracy of measuring means for protection systems of important objects.

Results. The independent from temperature change variations of ultrasonic method of protection of important objects have been suggested, based on a two-channel measurement and functional transformation of time parameters of the reflected ultrasound signals, allowing us to reduce errors decision on infringement controlled zone. The ways of implementation of the proposed method for the criterion of specified accuracy and ease of implementation have been researched.

Novelty. The scientific novelty of the results lies in the fact that we have suggested the independent from temperature change variations of ultrasonic method of protection of important objects and the ways of implementation.

Practical significance. The obtained results may be a basis for designing of the protection systems of important objects.

UDC 004.047**DETERMINATION OF DEPENDENCE BETWEEN PROTECTION MEANS AND ESTIMATIONS OF DATA SECURITY IN SOCIAL NETWORKS**

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Research methodology. The proper standards are determined by necessary facilities of protection, which are oriented to protection of the components indicated in standards and processes which are activated at the use of ICS. The existence of the real dangers of Nbi, which can activate, or not activate an attack, has been analyzed and researched in the article, that encourage the appearance of processes of change of some system security, and also the presence of threats which use attacks for penetration in the environment of the protected object.

Results. The research of violation of strength of the system ICS security has been conducted, which consists in the hidden unauthorized division, SND, that when the sanctioned user, having a password and identifier and getting access to the system can carry out unauthorized operations. They use the user's profile to find him. For counteraction SND they use the labels of separate objects of the system which the user applies to. The label chooses additional identification information of the user from the system of access, and also the information, which has been used, is written down on it.

Novelty. The analysis has been conducted and dependences have been researched between protection means and estimations of security level of these informative systems.

Practical significance. In the article the estimation of determination of dependences has been researched between protection means and estimations of security level of these informative systems, which is formed as a security profile of the concrete system.

UDC 004.78:007**ANALISIS OF MODELS OF COMPUTER NETWORK PROTECTION**

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Research methodology. The article presents the methods of forming adequate information of all aspects of the functioning of the MCM and the methods of its description as analytical processes depending on the system. The solution to this

problem is the approach that is to use information means of describing processes and information aspects of their operation. They use information components to install traffic between the workstation and network transfer functions of the central node in a computer network migration function of the central unit and the degree of relevance of the data interpretation.

Results. In networks that are focused on working with users, information tools are always used to implement dialogue between a system and a user, and they are used only as information components and semantic vocabularies describing in interpreted as a display component and system elements in an accessible user form. Within interpretational descriptions the restrictions are introduced on the methods of formation by normalizing grammatical rules, and input parameters corresponding descriptions that allow analyzing, are used to build a model that reflects aspects of the system. The impact is the contraction of certain phrases opportunities that arise through common understanding of the grammar of natural language users.

Novelty. A migratory center MCM describes how ideas about migration events in the system, in consequence of which migrants structure increases fault tolerance of the system, which is one of the important parameters of MCM based on analysis of the problem of creating. This approach makes it possible to implement management practices of MCM migratory patterns, based on the fact that each of the communication nodes of MCM has identical control systems. The fulfillment of these conditions ensures the uniformity throughout the MCM.

Practical significance. In the mobile computer network there are situations which are not described by the algorithm of centralized management, so that there is a need to analyze information collected and summarized by a control center, which in its turn determines their relevance. In addition to these factors within the system the commands are initiated that are implied by factors that are external in relation to the MCM, and, therefore, the following commands are initiated by users of the network serving it. Additional data are needed to perform commands such as moving in the current status of their implementation, MCM system to go into one of the special modes of operation. In this case, the information about the state of the system gets the actual status.

UDC 655.52

MATHEMATICAL MODEL OF MOIRE FORMATION BASED ON PERIODIC MULTIPLE LATTICES TO PROTECT DOCUMENTS

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Research methodology. The methodological bases of research are principles of protection related information which are based on the priority of protection against falsification of printed and electronic documents. The identified conditions of topics

have been included in general scientific methods of mathematics models which made it possible to develop a method of protection based on the formation of moiré and provides a reliable and effective protection of printed documents and ensure the integrity of the document. The method is effective and difficult to falsification as a latent image is visually visible in the process of creating copies of the document.

Results. In a separate study we have conducted and analyzed the principles of the construction technology to protect documents with the formation of moiré based on multiple periodic lattices. The model of moiré builds thin circular curves or lines that form a copy of moiré thus protect documents from forgery. Having analyzed the work we have done a mathematical model that allows you to make the most effective protection. Conclusions and synthesis confirm that the technology helps protect documents and thus lead to better results, which reduces the possibility of falsification of documents. The mathematical model of moiré has two layers for the case where the auxiliary layer has period k -times smaller than the period of the base layer, thus $T_b = kTr$ and on the basis of the existing period changes depending lattice moiré T_m the angle of inclination of the base layer lattice α_b and the period of the base layer $Tr \in [0.01]$. The mathematical model of moiré has two layers for the case where the thickness of the lines on the base layer greater than the thickness of the support layer, thus $T_b = Tb + l^* i$ on the basis of the existing period changes depending lattice moiré T_m the angle of inclination of the base layer lattice α_b and the period of the base layer.

Novelty. Scientific novelty of the results is that the technology does not require the use of new materials that makes the development of economically justifiable and appropriate. The results can be used to create print documents that require security and protection of information in the electronic media security features. The developed method of protection is effective and difficult to counterfeit, as images which are hidden become visible visually in the process of creating copies of the document; the essential components of the concept of publishing on creating protection technology moiré lattices from multiple structures have been researched and highlighted.

Practical significance. The method of protection that is built on identifying moiré effect allows distinguishing fake copies as the originals visually easy. When a user creates a copy of this document a lattice is created, which distorts the appearance of the document and distorting forms, or even completely loses of picture elements with copy. The technology involves protection of the document which prints with the method of protective elements. The essence of the model is to create an electronic document with the application of security elements of the printing method. Protective vector elements are created by and derived from technology PDF. When trying to digitize a document it forms moiré. The documents include security elements, thin lines which are made with less optical resolution repetitions, the value of which is less than the basic resolution copying or scanning technique that makes protection of documents reliable and cost-effective.

UDC 621.391

THE DEVELOPMENT OF LOAD BALANCING METHOD IN SDN NETWORKS BASED ON MODIFIED PROTOCOL STP

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Research Methodology. In this paper, the method of load balancing in software-configured network which is based on a modified protocol STP for avoidance loops and logic operation of controller SDN at the switch packet processing Openvswitch have been developed. This method is written in Python programming language and implemented in a software emulator Mininet with the ability to research the effectiveness of distribution network flows in SDN networks.

Results. The studies show that the proposed method of load balancing is the winning to transmitted information on the network with three switches, the expectation of the useful volume of traffic. For non modified module: using get $m_{x(\text{без.мод.})} = 98.6$ Mbit/s standard deviation $\sigma_n = 1.1$ Mbit/s; For optimized module $m_{x(\text{із.мод.})} = 194.5$ Mbit/s standard deviation $\sigma_n = 2.6$ Mbit/s; The increase in the expectation of profitable traffic volume of 96.9%, while the expected $I = (2/3) * 100\% = 100\%$.

The results for the experiments show that the actual increase of capacity is projected. Errors resulting, due restraint performance switches and terminal devices themselves, which are actually virtual machines that use one CPU resource - CPU local machine.

Novelty. The method of load balancing in SDN network that allows using Openflow protocol and the modified protocol STP consider additional ways for transferring and balancing different kinds of flows from end to end has been proposed for the first time.

The practical significance. The results of research will help assess the suitability of the network's data given species. To detect potential bottlenecks in telecommunications system for its modernization. To form a proposal to change the topology of the network and software architecture active aggregating equipment will facilitate the introduction of new network technologies and will enable improve SDN network settings at the lowest economic cost.

UDC 681.124:686.1.053

**STANDARD CIP4 / JDF – A NEW TREND IN MODERNIZATION
OF INFORMATION CONTROL DEVICES
OF NATIONAL PRINTING EQUIPMENT**

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Research methodology. We have used a formal method of (theoretical - multiple) systems representation, multilevel hierarchical systems theory and systems analysis.

Results. The present research describes the functional representation of the multilevel international consortium structure CIP4 analyzed the hierarchical structure of JDF/JMF - communication and developed practical recommendations regarding the choice of software and hardware platform of national printing equipment in due to with international standards CIP4/JDF.

Novelty. Functional representation of the multilevel structure CIP4 international consortium whose goal is to develop a consistent set of specifications describing the interaction of the extended chain of printing processes and production management has been presented. The recommendations for the creation of a new working group under the direction of the consortium CIP4 metrological provision of quality printing products and semi-finished products for their accuracy of dimensional size parameters of the simultaneous acquisition of membership in the above consortium have been given.

Practical significance. Based on the analysis of hierarchical structure JDF/JMF – communications, we have offered some recommendations on choosing a software and hardware platform with the use of programmable logical controllers of firm Siemens to design JDF - compatible national equipment.

UDC 004.738.5

**METHODS OF MANAGEMENT OF COMMERCIAL WEB -PROJECTS
UNDER CONDITIONS OF UNCERTAINTY**

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Research methodology. The theory of systems and system analysis have been used to perform process of analysis of making decisions process in web project management, and to classify the factors of making project decisions. For developing

methods of elimination of uncertainties set theory, mathematical logic, fuzzy logic and theory of predicates have been used. For developing the method of choosing web project management strategy, the Analytic Hierarchical Process has been used.

Results. In this study the method of management of commercial web-project based on the use of fuzzy logic and choosing project strategy using Analytic Hierarchical Process has been proposed. The ways of forming design decisions in management process of commercial web-projects in conditions of incompleteness and inaccuracy of certain project characteristics have been described. The nature and causes of the emergence of incompleteness and inaccuracy of project characteristics have been defined. The procedures of reduction of the level of incompleteness and uncertainty of characteristics of the project, based on fuzzy logic, have been developed. The proposed method makes possible creation of means of processing data in web-projects and implementation of subsystem of web project management.

Novelty. The scientific novelty of the results lies in the fact that there have been developed web project characteristic specification that makes possible using of incomplete and inaccurate data for making decisions in web project management; method of processing of uncertainties in project characteristics which uses fuzzy logic and norming of values; method of choosing web project management strategy based on inaccurate and incomplete data.

Practical significance. The paper has practical significance that consists in development of algorithm for processing uncertainties in web projects' characteristics and method for choosing strategy of a web project management under conditions of uncertainty.

UDC 686.12.056

THEORETICAL STUDIES OF POWER PARAMETERS OF BOOK BLOCKS TRIMMING WHEN MOVING ON CIRCULAR TRAJECTORY

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Research methodology. The methodological base of research of the process of book blocks trimming by a multi-blades cutting tool during their movement by circular trajectory is a mathematical modeling system MathCAD program and the software Microsoft Office Excel. The method of system analysis and modeling has been used in the study.

Results. Theoretical studies have shown that, setting the blade angle β_0 affects the length of the cutting line lp and the actual value of the cutting angle α_0 , and thus the strength of cutting. Taking into account the magnitude of cutting edges, the optimal angle of setting multi-blades cutting tool β_0 should be chosen in the range from 18° to 25° depending on the type of paper of which the book block is produced. For dense types of paper (e.g. coated with weight $m = 120 \text{ g / m}^2$, density $\rho =$

1,30 g/cm³) it is optimal in terms of both cutting force, to set the blade angle $\beta_6 \approx 25^\circ$. For more friable types of paper such as newsprint with mass $m = 50$ g/m² and density $\rho = 0,6$ g/cm³ and offset number 1, $m = 75$ g/m² and density $\rho = 0,74$ g/cm³ it is optimal to set the angle $18^\circ - 20^\circ$, cutting depth δ by one blade of 0.3 mm to 0,7 mm and a radius of curvature of the blade cutting edge to 0.01 mm.

Novelty. The research results have been obtained for the first time and present scientific novelty, as related to a new way of block trimming during transportation and tools for its implementation.

The analytical determination of the total dependence of cutting force with regard to a particular type of paper and geometrical parameters of multi-blades individual cutting tool has been received.

Practical significance. The results of theoretical studies set the conditions for the optimization of technological parameters of the trimming process, geometrical sizes of multi-blades cutting tool, which is important when developing a new and modernizing the existing equipment.

UDC 686.12.056.

EXPERIMENTAL RESEARCH METHOD OF FORMED «WAVE» DURING BOOK AND MAGAZINE BLOCKS CUTTING BY FLAT CUTTING INSTRUMENT

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Research methodology. The methodological base of experimental researches of the book blocks trimming process transported with the set speed to the zone of rigidly fixed flat cutting tool with a curved blade edge are general scientific methods: photography and speed video registration of the process of the «wave»; formation, quality assessment of the book blocks trimming plane; mathematical processing of experimental results.

Results. The conducted previous experimental studies have shown that, regardless of the paper type, transportation speed of the unit and geometry PI – the formation of a «wave» as a result of deformation of the block sheets is inevitable; increasing of sheets deformation («wave») causes the actual cutting angle, which in turn leads to an increase in the total cutting force; the formation of «wave» leads to a decrease in precision of cutting.

Novelty. The research results have been obtained for the first time and present the scientific novelty, as related to a new way of trimming units during transportation and tools for its implementation.

The inevitable of formation of a «wave» as a result of deformation of block sheet has been proved regardless of the type of paper on which it is made, the unit transportation speed and the geometry of the cutting tool.

Practical significance. The results are valuable in the design of new printing equipment. To reduce the size of «wave» you should minimize the angle of attack of the blade cutting tool at the point of cutting edge in power and minimize the distance between the planes of cutting and clamping.

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ANALYSIS OF FEATURES OF NEW STANDARD FOR OFFSET PRINTING ISO 12647-2: 2013

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Research methodology. The research methodology is based on the principle of comprehensiveness, credibility and scientific objectivity, based on the latest data characteristics of colorimetric measurement process of inks imprints obtained by offset printing. The study has used new methods of digital image processing and statistical methods of experimental data processing in specialized software.

Results. In the study we have calculated the index of nonlinearity of standardized printing process on coated premium (PS1) and non coated (PS5) papers. Graphs illustrating the features of the color reproduction process of triad inks for the printing conditions according to the new edition of ISO 12647-2: 2013 have been built. The paper presents spectral characteristics of inks on the paper type PS1. The comparative analysis of technological parameters regulated by both editions of the Standard ISO 12647 has been made.

Novelty. Scientific novelty of the results is that the calculated values of the nonlinearity, which describes new printing conditions, can be used to model the optimal process conditions of reproduction of multi-ink images, design of control scales for assessing the quality of imprints.

Practical significance. The authors have described the changes made by developers of ISO standard for offset printing that has practical value to printing companies that adhere to international standards and recommendations and will go to the conditions of reproduction, according to the new edition of ISO 12647-2: 2013.

UDC 004.423**MODELS OF GEOMETRICAL OPTICS AND LENTICULAR PRINTING**

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Research methodology. Mathematical modeling and lenticular printing technique in printing.

Results. The analysis of lenticular printing has been done.

Novelty. The model of lenticular printing has been analyzed for the first time using the laws of nonlinear optics.

Practical significance. The work has important applications for lenticular printing in a modern printing industry. It can be implemented in organizations engaged in lenticular printing.