INTERCONNECTION OF EFFECTS OF PEAK AND LATITUDINAL IMPULSIVE MODULATION IN THE PROCESS OF DEEP PRINT AND HIS INFLUENCE ON QUALITY OF MAKING OF DOCUMENT IN CALS-TECHNOLOGY

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Decision of problems of influencing of interconnection effects of peak and latitudinal impulsive modulation in the process of deep print for making of document in composition of CALS-technologies on quality of images needs explanation of many theoretical aspects. Interconnection of effects of amplitude and latitudinal impulsive modulation in the process of deep print for making of documentation in composition of CALS-technologies discovers itself as characteristic damages on the different areas of reproduction.

Introduction. The phenomenon of peak and latitudinal impulsive modulation in the process of deep print for making a documentation is known for specialists [1], somewise connected with a polygraphy, or making of technical document in composition of CALS-technologies for a civil aviation, treatment in the process of electronic-digital reproprinting of images (EDRI) or preparation to the printing. Actuality of the problem of such phenomenon learning as interconnection of effects of peak and latitudinal impulsive modulation in the process of deep print for making of document in composition of CALS-technologies, is known [2] because it in theory combines all types of images damages. Actuality of influence research of interconnection effects of peak and latitudinal impulsive modulation in the process of deep print for making a documentation in composition of CALS-technologies and quality of images, which are used in CALS-technologies for a civil aviation, is also known. This problem disturbs us in realization, at first sight, maximum simple task — recreation of high-quality reproduction by a polygraphy method for circulating of document [3].

From history of question. There is known [4] the simpler and the most laconic explanation of the origin reason of interconnection effects of peak and latitudinal impulsive modulation in the process of deep print for making document in composition of CALS-technologies. It is the dismemberment of stroke elements by a periodic raster, which causes defomation of maximum areas of strokes. Different researchers have offered measures, with the help of which strike line contours become even. Thus inside of a stroke the raster structure of not quadratic rejection is saved and s.o. That is why in a number of cases of ranging, for example, of imprints, printed on a different paper (tabl. 1), to objective and subjective estimations appeared weakly, that correlate mutually. Especially strongly such inconsistency showed up at comparison of the same type standards of printing paper. Experimental investigations, conducted by authors, showed, that principal reason of these failures became transformation of nonhomogeneity signet by frequency descriptions, which show rather considerable influence with the subjective estimation of printing imprints quality.

Analysis of the last researches, in which the problem decision of influence of interconnection effect of peak and latitudinal impulsive modulation in the deep print process for making document in composition of CALS-technologies on images quality [6] is founded, consists in that it seems impossible the decision of EDRI process practice problem by its programme-hardware facilities without the help of elaboration of modern positions of theory. Interesting to look, that these difficulties, which, for example, were tested in the Dutch institute of polygraphy researches [7] at comparison of subjective estimations and middling quadratic rejections of optical closeness of chaser die at control of the same paper type groups, were easily accountable, since frequency descriptions of paper acquire prevailing value exactly in the cases of control of the same paper type groups. Only, probably, with absence of necessary devices it is possible to explain that, doing a correct analogy between a printing imprint and photo image, only measurings of middling quadratic rejections limited to sizes by methods, accepted in a photo, but not in electronic images.

For the exactness analysis of transmission of microline areas of image different scientists [1] used methods for the estimation of granulation in passing or reflected light, and also original conceptions, based on statistical nature of the considered phenomenon with the purpose of picture development , but not electronic images, which have other specific. However and here estimations were limited to one size: or by the average value of gradient of optical black and white line closeness, or coefficient variations of reflection of elementary raster area were examined, which contains one raster point, or size of raster elements (RE) area. Offered and tested different and very useful methods (templates, photomicrographs, photo-electric and other) measuring of RE area on a form and imprint owing to the force of circumstances also could not be the basis for the complete objective estimation of image transfer exactness in EDRI for making of the high-quality technical document.

Raising of a problem in a general view and its connection with important scientific tasks lies in research of influencing of interconnection effects of peak and latitudinal impulsive modulation in the process of deep print on quality of document making in composition of CALS-technologies, which can be caused a number of reasons, beginning from the wrong mode of EDRI, their improper treatment and ending with incongruous tuning on the stage of forms making and by the printing process and its influencing to images quality. The special attention is deserved by consideration of question about the degree of accordance of peak-impulse modulation and real observed on a practice mechanisms of forming of image in the deep print process. Obviously, that if we were limited to the only idealizing picture of presentation of image on imprints, had gotten by the method of deep print, as infinity number of discrete elements, which have an identical form, but differ one from one only by intensity, then principle difficultly accoutable within the framework of this idealization contradiction would arise up.

A research purpose is making of high-quality colordistriduted forms on a tape, or on a paper subject to the influence on quality of effect interconnection images of peak and latitudinal impulsive modulation in the process of deep print for making a documentation in composition of CALS-technologies. The features of display of effects interconnection of peak and latitudinal impulsive modulation in the deep print process investigated for making a documentation in composition of CALS-technologies because they stipulate for impossibility the problem decisions of optimal process of reproduction programme hard-ware facilities without the help of new positions of theory and modern technology using.

New approach for the decision of problems is expounded in a hypothesis [3] and consists in next. Possibly in an experiment, that the point is that even at very high intensities of colourful layer the maximal, in theory possible value of integtal raster optical solidity I_n in peak-impulse system ha integral of Other at the amplitude impulsive system must be considerabs to be much lower than similar description in autonomic system. It is set that depending on porosity of impulses in the peak-impulse system a specific area RE makes 0,4 – 0,7 at that time as in the autonomic system its maximal quantity equals unit. Influence of specific area of RE size on a size is sufficiently strong and that is why within the framework of the resulted idealization of process which was investigated in an interval ΔI_n. he had to be insignificant enough $\Delta I_n \approx 0,3 - 0,5$.

Scientific result , which is got on the basis of application of the developed elements of theory and scientifically methodical device expounded in [5] and consists in the following. In actual fact interval of optical solidity of images, that by the method of deep print reproduce not less, but more than at the use of the peak systems and reaches 1,4 – 1,6 units of optical closeness in despite of that on the printing forms cells sizes are little enough change (within the limits of 20% for areas) in dependence at their depths and practically in all of interval remains permanent on reproduction, and on printing imprints obviously there is an peak effect, that expansion of RE up to even filling by the paint of

all area in shades of image. In shades due to this effect a raster structure disappears in general, and dark areas obtain character of continuous chaser die. In this case by reason of change of RE area on an imprint there is a specific of printing process in which viscid easily fluid printing-inks based on organic solvents are used.

Exposition of basic research material with the complete argumentation of received scientific results, it is done in [5]. It is suggested to use in the model of process some modern looks for the estimation of influence of the phenomenon, which is examined on images quality by descriptions and analytical calculations. Formal, effect of RE area change on the imprints of deep print depends on the depth of raster cells on a printing form, it means that we can examine the expansion of impulses depending on their amplitude as influence of filter of lower frequencies on periodic sequence of equal wide impulses. For the gradation description of deep print process looked like enough smooth curve, the original balancing of simultaneous influence is needed on the quantity of raster optical closeness of peak-impulsive effects and latitudinal impulsive modulation. With the purpose of estimation of these phenomena we convert the known formula [6] to the kind, comfortable for an analysis process

$$D_r = \lg \frac{1}{1 - S_{ef} \cdot (D_r) \cdot (1 - 10^{-ef})} \quad \text{if } S_{ef}<1 \qquad (1)$$

Where $D_r = D_e$ if $S_{ef}=1$.

$S_{ef}(D_e)$ – an effective quantity of specific RE area, numeral equal to the specific area of screened image with set values D_e and D_r.

Minimum value of S_{ef} corresponds the specific area of raster cells of printed form, that determined by porosity of raster structure. A maximal value is determined at at the uniform ceiling of area in the process of EDRI. At the uniform ceiling of intervals between impulses the quantity of raster optical solidity is equal to optical closeness of raster element D_e. The uniform ceiling of impulses can take a place before, than maximal value of optical closeness of copy reaches, that is at some value D_p. Appropriately to assume that during linear low frequency filtration the change of RE width is proportionally to the size of their peaks of D_e, and the change of specific RE area is proportionally to the square D_e

$$S_{ef}(D_e) \approx S_o + k_{ef}^2$$

Numeral value of coefficient to D_o is possible to define from condition $S_{ef}(D_n)=1$ (2)

$$k=(1 - S_o)/ D_n^2 \qquad (3)$$

Quantity k reflects in maximum measure the property of print process, as filter of lower frequencies. The greater k, then the less effective width of a strip of passing process frequencies, the more raster structure on a documentation during printing suffers frequency twisting. Analysis of experimental information, received on different devices, інтуїтивно confirms enough supposition, that quantity k depends on viscosity of printing-ink, growing with diminishing of viscosity during another equal conditions.

Consider that quantity k must depend on the regimes of realization of print process at CALS-technology and printing-technical properties of paper for a technical documentation.. Unfortunately, in works, devoted the experimental investigation process of deep print [7], these very important characteristic on our opinion didn't determined. It is rather expedient to think that for the filter influence control we use the process of deep printing on the frequency spectrum of the image of special continuous scale of halftones and next visual finding of ceiling RE area on an imprint with the objective dimension of optical solidity of lower boundary of this area D_p . In the area of action of quadratic specific RE area dependence from their amplitude, probably next relation must be right.

$$D_r = \lg 1 / 1 - [S_o + (1 - S_o)(D_e / D_p)^2](1 - 10^{ef}) \qquad (4)$$

Correlation (4) is one of modifications of the known formula (1) in relation to the case of deep print. It can be used for an estimation of dependence of raster optical closeness on De, So and Dp . Certainly, as the initial formula, this relation is right just on condition of ignoring the quantity of optical paper solidity for a tekhnich document and the known effects of EDRI.

The hypothesis of decision of existent problems [3] consists in the following. The phenomenon of RE size instability on printing imprints in high light images presents some interest for general research of process. Because of the small depth of raster cells in this area obviously there are considerable variations of enough large RE area aside its diminishing to complete RE non printing. Not stoping on reasons of these phenomena, which are connected with physical essence of EDRI, and dynamics of deep print process, and depends on many technological factors, we will denote the fact of presence of printing process instability area in high lights of images. In an integral aspect, that is in character of influence on the quantity of Dr , these phenomena are equivalent, to some measure, to the peak and latitudinal impulsive modulation. That is why the upper boundary of print process is reasonably to accept such value of Dr, at which size of RE area with the sufficient degree of probability corresponds the area of raster cells on a printing form. Thus, it is suggested to break up the interval of deep print process on three areas: not about RE seals, areas of peak effects action and area of complete disappearance of raster structure.

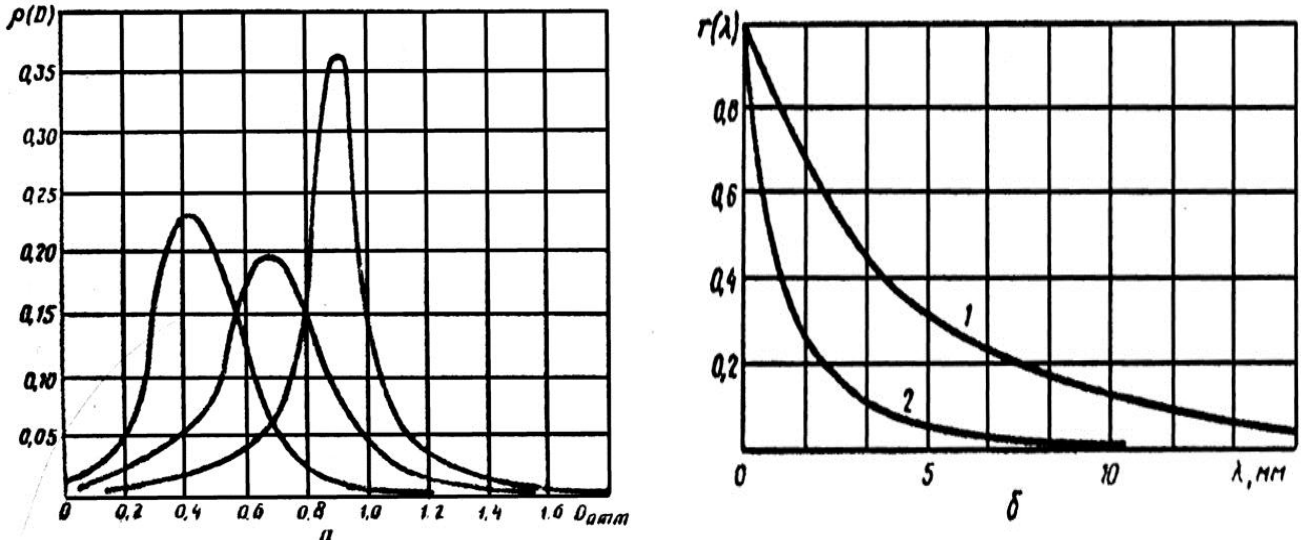
Confirmation of justice of assertions in a work is an analysis additional researches parameters , which were used for a design. Consider that the formal reason of size RE instability in high lights of image is too less depth of cells on a printing form. That is why possibility of increase of printing process stability is connected with an intentional increase of exactly this parameter. For that however general amount of paint in high image light was much less, than in the middle area of process, rational would be to realize the controlled effect of peak, that is regulated change of the raster cells area on the print form exactly in the area of high lights.

Position of modern science [2]is used in developments of elements of theory, what totally confirms fact, that from other side, in high shades of image the classical method of deep print due to adjusting of cells depth allows to reach greater magnitudes of D_r, than in another ways. Such increase of depth of raster cells is rationally only to the some border, because in the range of 30–40 mkm satiations effect advances, that is the amount of paint which passed to the imprint stops to depend on the raster cell depth. The observing effect of satiation is well explained by the theory of fragile break of paint layers in a printing process and determined sizes by specific energy of interaction between a paper and paint and superficial tension of paint on the boundary with air.

The personal membership dues of authors consists in the following. After numeral mathematical transformations we'll get results of design of process for the decision of problem of images quality increase through creation of modern theory of effects interconnection of peak and latitudinal impulsive modulation in the process of deep print for making technical document in composition of CALS-technologies, which discovers itself as characteristic damages on the different areas of reproduction. Thus, the process of forming of deep print image is not adequate to simple peak-impulsive modulation by rectangular impulses at screening. Effects of latitudinal impulsive modulation, filtration and peak limitation are quite obviously observed. Reverse effects of low frequency filtration are observed in the area of instability of printing

process, that is the action of above enumerated links has a lower level of limitation. A study and accounting of action of all these factors will allow in future to open completely possibilities of reproduction of images using the method of deep print.

The special problems arise at the recreation of stroke images in EDRI (including the text of deep print). A deep print (it belongs to stenciled also) has the worst possibilities of recreation in it relations in comparison with another ways of seal (high and offset). Because of specific features of this method we have to screen seal stroke and text images using other methods. As well as at researches of other authors [1], it was experimentally set on a designing complex EDRI, which includes a laser formed automat (LFA) and a device "FAKEL", that variations of magnitude of optical solidity of chaser dies have a normal division with the sufficient degree of authenticity (after a criterion x_i-square) (pic. 1a). In addition, unlike previous researches, their auto correlation (pic. 1б) and power descriptions were experimentally determined.

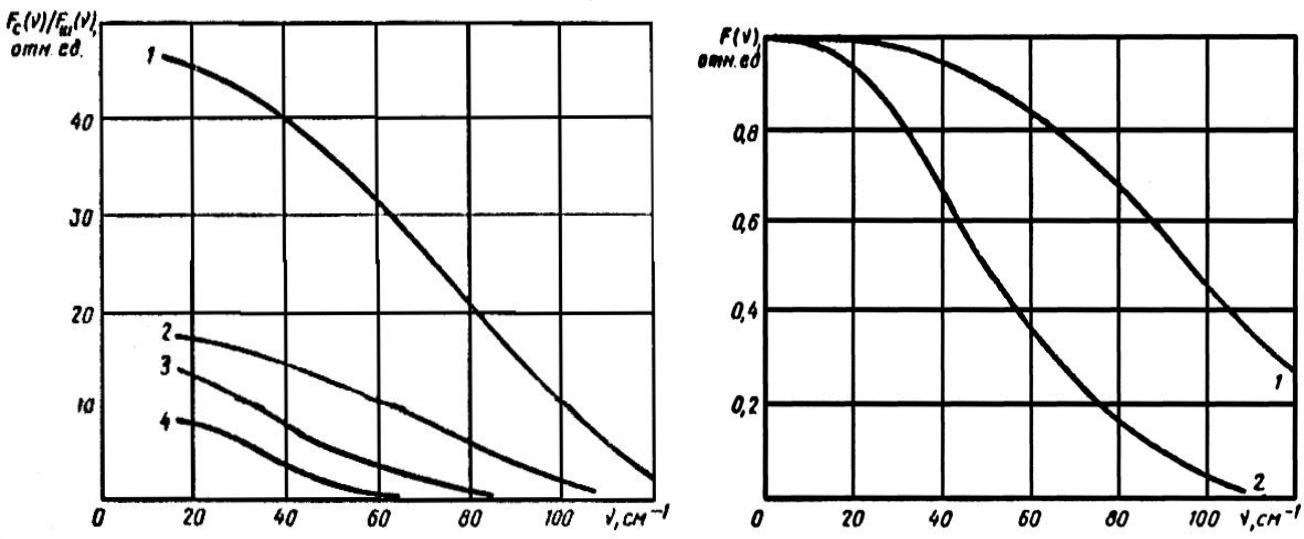


Pic. 1. Solidity of division of optical closeness of different on a thickness printing imprints (chaser die) – (a) and the coefficient of autocorrelation of optical closeness of printing imprints (chaser die) of visual satisfactory (I) and unsatisfactory quality (2) – (б).

The analysis of autocorrelation functions showed that on it's look they are very close to exponents. In exceptional cases, in particular for a paper for a technical document, in the power spectrum obvious resonance lances and descriptions appeared. Thus, experimental researches showed that variations of optical closeness on the equal printing imprints (chaser die) fields can be well enough described as a two spaced process or, that is exactly the same, as normal noise, which got through an inertia link. In a statistical content the characteristics of variations of optical chaser die closeness are analogical to the proper descriptions of a semitone image in EDRI. It is possible to assume (it will be shown bellow) that a printing process on the frequency descriptions is analogical the filter of lower frequencies. The basic parameter of this filter (effective strip of admission or interval of auto correlation) depends on a method (high) and terms of seal (pressure, thickness of colourful layer and other) and properties of printing paper for a technical document. As it was foreseen before, auto correlation (frequency) descriptions of printing imprints (chaser die) influence on a observer's subjective estimation of a seal heterogeneity parameter.

By analogy with a semitone image, it would seem, it costs to analyse passing in the printing process of test-object cosinity and to get frequency contrasting description. For printing processes it is impracticable, because all basic methods except of phototyped can not realize a direct semitone image transfer. That is why the attempt of indirect determination of peak frequency description of raster printing process was begun. As an analogue of cosine signal, the peak of the first accordion of radial micro stroke measure, which has porosity 0,5, was measured.

Noise in experiments identified with the effective value of fluctuation of peak of the first accordion of radial measure signal. For comparison experimental information for the processes of the high printing on the high-quality chalky paper are given on (pic. 2). Information about noise for the case of the high-quality high printing is presented (pic.3), since it was within the limits of error of measuring and it was taken by us conditionally as equal to one relative unit in all of range of the probed frequencies. In the case of analysis of noises in a newspaper high printing it was made clear, that noises are enough considerable. Even in law frequency part of spectrum their specific weight makes 10-14% of the quantity of basic signal.



Pic. 2. Dependence of signal/noise to frequency for the processes of high printing on the chalky (1), natural vanished #1(2) and on the #2 (3) grades of paper and paper for newspaper printing (4).

Pic.3. Comparison of frequency characteristics of processes of offset (1) and high printing (2) one kind of paper (by a facility mechanism #1 for high printing).

The choice of extreme cases (high-quality and newspaper paper) for making of high-quality technical document was done intentionally in an experiment for inclusion providing of all realized possibilities of high printing, which are shown in table1.

Table 1

Description of high printing processesnon the different types of paper

Paper name for producing document	Ratio of the signal/noise in the range 0–20 , cm	Effective strip of frequencies (on tyhe level *0,7*) Y_{ef}, cm	Maximum process frequency cm	Specific information capacity V_{pr}. un./ cm^2
Chalky	45	60	125	$15 \cdot 10^4$
Vanished #1 for high printing				
Vanished #2 for high printing	16–20	50	125	$8{,}4 \cdot 10^4$
Newspaper	13–18	35	110	$4{,}5 \cdot 10^4$
	6–10	30	100	$2{,}2 \cdot 10^4$

Conclusions and prospects of subsequent researches in scientific subdirection of images treatment consist in that first untraditional approach is offered, which will help to solve problems using creation of theory modern elements . It allows to do more exact calculations at constructing of the systems and complexes, and also at using of maximum possibilities of EDRI, for the increase of quality of technical document. Offered new theory refreshes by fundamental researches and by calculation information which was used in work, for confirmation of the got results in the design process.

In a conclusion it should be noted that all these experimental results were got during work on LFA or on a device „FAKEL" with the use of the same paints, that provided their comparableness. Naturally, that in the real printing processes on aviation indicated above quantities can endure considerable changes depending on the concrete modes of seal, type of printing equipment, parameters of printing-ink and paper for a technical document.

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