

The Employment of Sensitometric Control Methods in Digital Photographic Systems

*Elena V. Konstantinova, Igor A. Rotakhin, Victor E. Tok, and Denis M. Korchakov
St.-Petersburg State University of Moving Picture and Television
St.-Petersburg, Russia*

Abstract

Lately, we are witnessing an increasing penetration of digital information registration methods in various domains of science and technical knowledge. Digital systems are very attractive because of their universal use, flexibility, swift action, simplicity of technical realization, higher stability, accuracy and reproduction quality in comparison with analogous methods. In particular, digital methods of recording, processing and reproduction are widely spread in cinematography, television, and photography.

When working with digital photography technologies, one of the most important problems is development of unified methods for the evaluation of quality of an image on every stage of the photographic process with the use of digital image conversion (digital photographic process).

Experimental

This monograph contemplates the possibility of the employment of sensitometric control method in hybrid photographic systems. There was also studied the influence of the value of sensitometer wedge constant on the accuracy of the defined parameters; furthermore, there was developed method of construction of objective tone reproduction curves and characteristic curves on the basis of computer simulation of photography process and densitometric calibration of digital local drives.

In previous works the calibration was based on colorimetric figures, however, in this work we used densitometry for our purposes.

The calibration curves were obtained by correlation of density behind red, green and dark blue filters (densitometer Brumicro) and RGB figures. (fig.1)

The above enables to improve conditions for receiving an image with set quality characteristics and to exercise visual control over the image on every stage of the process.

On the basis of the results of this research it is possible to make a conclusion about the possibility of the use of evaluation methods of photographic characteristics and tone reproduction parameters, which are used in

traditional silver halogen photography, for hybrid photographic systems and digital photographic systems.

Approbation of this method was carried out in the environment of an industrial enterprise in order to compare the accuracy of sensitometric parameters approximation for optical wedges with different constant.

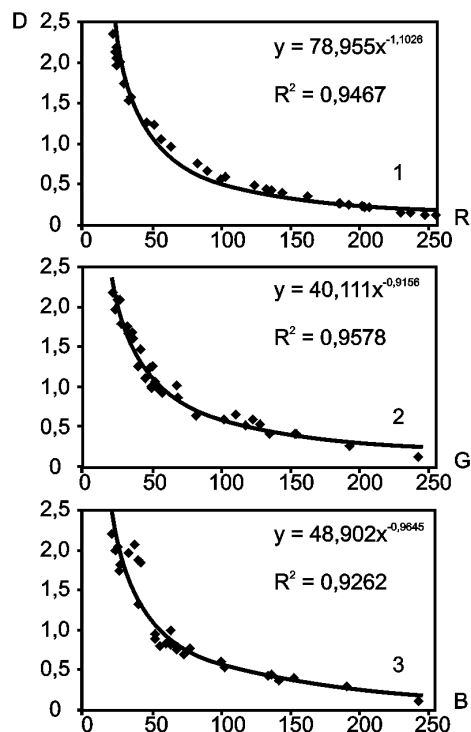


Figure 1. Calibration curves for converting RGB values into optical densities: 1-behind red filter, 2-behind green filter, 3-behind blue filter.

Tests carried out in the cinelaboratory of Leningrad Cinema Factory showed that the developed set of programs allows to restore characteristic curve and calculate sensitometric parameters of films with good accuracy and that the choice of assessment method is made depending on the requirements towards the time available for receiving results, accuracy of the defined

parameters and methods of visual presentation of the results.

Findings are shown in table 1.

There was studied the influence of the value of sensitometer wedge constant and method of graphic-analytical constructions on the accuracy of the definition of sensitometric parameters. It was shown that the use of optical wedge with constant $k=0.100$ as exposure modulator allows to improve substantially the accuracy of the defined parameters.

Table 1. Accuracy of Speed Definition in Compliance with the State Standard of Russia, ANSI and ISO standards.

Film	D_{min}	Speed number (in accordance with the method)					
		Interpolation		Graphic		Statistical	
		S	$\Delta S\%$	S	$\Delta S\%$	S	$\Delta S\%$
State Standard of Russia (k=0,150)							
FN 64	0,38	35,2	13,1	34,3	13,2	41,5	13,7
T-MAX100	0,35	110,7	19,1	112,5	15,1	121,2	14,1
FN 100	0,30	70,4	20,3	73,1	13,1	80,4	14,5
Foto 250	0,31	170,5	21,5	201,2	17,1	190,3	19,9
ISO Standard (k=0,150)							
FN 64	0,38	60,5	14,8	61,1	13,1	67,5	14,0
T-MAX100	0,36	81,5	9,4	79,5	11,3	76,3	10,3
FN 100	0,29	105,2	18,7	102,2	17,5	112,4	19,8
Foto 250	0,40	200,5	23,2	246,3	26,8	250,8	29,5
ANSI Standard (k=0,150)							
FN 64	0,40	45,2	20,2	43,5	23,5	49,2	29,8
T-MAX100	0,41	140,1	21,3	125,4	21,2	142,1	27,9
FN 100	0,30	85,3	19,1	88,1	20,4	97,5	26,7
Foto 250	0,30	230,2	29,3	247,7	28,1	212,4	34,4
State Standard of Russia (k=0,100)							
FN 64	0,38	33,1	4,6	27,4	4,3	35,9	4,0
T-MAX100	0,35	112,1	6,2	107,0	5,9	118,6	6,5
FN 100	0,30	71,0	2,2	70,4	3,9	77,9	4,8
Foto 250	0,31	170,4	0,4	200,0	3,1	205,5	6,3
ISO Standard (k=0,100)							
FN 64	0,38	57,1	0,9	63,4	2,1	65,5	4,4
T-MAX100	0,36	76,6	1,4	78,3	5,1	72,1	6,4
FN 100	0,29	103,0	1,5	106,2	4,9	105,7	5,2
Foto 250	0,40	207,8	1,2	239,2	2,3	205,4	4,7
ANSI Standard (k=0,100)							
FN 64	0,40	45,4	1,8	43,2	3,5	49,1	5,8
T-MAX100	0,41	140,0	1,7	125,3	4,2	148,3	5,9
FN 100	0,30	85,1	2,4	88,1	5,4	97,4	6,7
Foto 250	0,30	200,0	2,3	247,6	6,1	216,3	7,4

There was developed a software and hardware complex for the calculation of tone reproduction parameters in the through photographic process and definition of the optimal conditions for carrying out through photographic process in order to achieve the best, from the point of view of tone reproduction, quality of photo image as in accordance with the results of the objective tone reproduction curve analysis, as in accordance with the results of visual information seen on the computer monitor. This provides an opportunity to make forecasts of photographic process results, considerably reduces time and materials used for preliminary tests, allows to control quality parameters of tone reproduction of photo imprints in a more effective way and receive image with the set parameters.

On the basis of this research results it is possible to make a conclusion about the possibility of the use of densitometric method for photographic systems with digital image conversion.

References

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Biography

Elena Konstantinova received her B.C. degree in chemical sciences from the Institute of Cinema engineers at Leningrad in 1985 and a Ph.D. in technical sciences from the St.-Petersburg's state university of moving picture and television.

Since 1985 she has worked at cathedra of photography of St.-Petersburg's state

Her work has primarily focused on the university of moving picture and television as a lecturer.problems of tone and color reproduction in silver halide photography and digital photographic systems. She is a member of the IS&T.