

ABSTRACTS

Yakovlev V. A., Shokin Y. V., Zhurenkov A. G., Khrapovitskii I. V. **Optical communication channels with underwater vehicles and directions of their development. PP. 3-10.** The actuality and development stages of optical communication channels with underwater vehicles are discussed in this article. Examples of applications and proposals for their further improvement are given. **Keywords:** optical communication channel, optical systems of underwater communication, laser communication, underwater vehicles, navigation, aircraft, space satellite

Belousov Yu. I., Pantas Ya. S. **Errors in the guidance laser rangefinder on a tv or an ir channels due to the refraction of optical rays over the sea surface. PP. 11-21.** The well-known phenomenon of the refraction of electromagnetic waves propagating in a medium with a gradient of the refractive index is considered in relation to the estimation of target designation errors for a laser rangefinder from the side of the television and thermal imaging channels of the optoelectronic system. It is shown that when observing a point object, the divergence of rays of different spectral ranges can reach values that exceed all other instrumental errors in determining its angular coordinates. An example of a method for compensating for the influence of the refraction of a near water atmospheric path on the errors in pointing the rangefinder beam according to the data of passive detection channels is given. **Keyword:** refraction, laser rangefinder, television channel, thermal imaging channel

Demin A. V., Sechak E. N. **Algorithm for image quality assurance in high-aperture telescopes with segmented mirrors. PP. 22-29.** A two-stage procedure for geometric and opto-mechanical positioning of composite mirror segments is considered. An algorithm for positioning the mirror segments of a composite mirror relative to the base (calculated) surface for high-aperture telescopes with composite mirrors is presented. An autocollimation method for controlling the process of positioning mirror segments is proposed. **Keywords:** adaptive optics, composite mirror segment, remote sensing, alignment, phasing, mirror control.

Ostroumov O. A. **Procedure for providing functional stability of the communication system. PP. 30-38.** The paper considers a modern complex functional-dynamic communication system and the process of its functioning. It is shown that under conditions of various destabilizing factors influence and managerial influence of a higher-level control system, it is possible to disrupt the

system functioning. The process of the communication system functioning is considered as a set of interrelated goals, requirements, functions, tasks and resources of the system. A methodology for ensuring the communication system functioning stability is proposed, which consists in comparing the profile of the communication system functioning and the regulations for the implementation of this profile, as well as timely response, to the occurrence of conflicts in the system, which may cause non-fulfillment of the communication system target purpose. **Keywords:** functional stability, criticality, communication system, control system, functions, tasks, profile, regulations

Vargin P. S. **Outline image coding. PP. 39-54.** Methods for coding digital images using centrally symmetric masks, which lead to the formation of contour images, are considered. The possibility of direct decoding (deconvolution) of the contour image is shown. An algorithm is proposed for fast smoothing (interpolation) of local image defects using the iterative upper relaxation method when solving the Dirichlet problem. The features of encoding and decoding images on a hexagonal grid are shown. **Keywords:** deconvolution, rectangular and hexagonal grids, Laplace operator, image processing, upper relaxation, Dirichlet problem, interpolation of image defects, smoothing

Kuzichkin A. V., Kovalchuk V. S., Gulyaev Yu. P. **A method for recognizing a fire by smoke and flame for a fire video broadcaster. PP. 55-64.** A method for recognizing ignition by flame and smoke in the optical range is considered, which implements spectral-spatial filtering of radiation in the observation zone and dynamic analysis of the characteristics of changes in the color temperature of the flame and the scattering ability of smoke. **Keywords:** detector, TV camera, video detector, fire, smoke, flame, image

Pavlov V. A., Zavjalov S. V., Pervunina T. M., Orooji M., Shariaty M. **Application of deep learning for COVID-19 classification and pulmonary edema on pulmonary CT images. Pp. 65–72.** The application of deep learning methods to classify COVID-19 and pulmonary edema in computed tomography images of the lungs is considered. A method based on a convolutional neural network has been proposed, which automatically distinguishes COVID-19 from pulmonary edema on CT images of the lungs. The proposed method is compared with the most famous ones, such as ResNet-101, Xception, VGG-16, DenseNet201 and VGG-19. High performance indicators were obtained: Accuracy (0.98), Sensitivity (0.98), Specificity (0.98). **Keywords:** convolutional neural network, pulmonary edema, COVID-19, computed tomography of the lungs

Pozdeev A. A. **Visual quality enhancement of of endoscopic images for clinical decision support systems. PP. 73-80.** The issue of increasing the diagnostic value of endoscopic images is considered. It is shown that independent processing of different image channels using nonlinear transform provides an increase of color contrast. A criterion for evaluating of color contrast taking into account the peculiarities of the human visual system is introduced. An image processing method is proposed. The method includes 2 steps: tone correction, contrast correction and provides an effect comparable to existing technologies of virtual chromoendoscopy. **Keywords:** virtual chromoendoscopy, contrast enhancement, color contrast evaluation

Rusin A. A., Bibarsov M. R., Ayukov B. A., Gordienko D. Y., Lyashchenko S. A., Dvornikov S. V., Ustinov A. A. **Analysis of immunity losses under slow fading. PP. 81-85.** The article discusses the results of a study of the dependence of the normalized value of the signal-to-noise ratio on the ratio of the effective voltages of the regular and diffuse signal components, provided that the same noise immunity is ensured in the Rayleigh and Rice channels. The graphs characterizing the influence of fading on noise immunity were obtained. Proposals for the practical application of the results obtained are formulated. **Keywords:** Rice channel, Rayleigh channel, slow fading, loss in noise immunity

Pogorelov A. A., Litkevich G. Y., Vlasenko V. I., Fomba B., Dyauara A., Dvornikov S. V., Pshenichnikov A. V., Ustinov A. A. **Justification of the selection of the threshold of the digital demodulator of amplitude-manipulated signals in the rice channel. PP. 86-93.** The article discusses the operation of a radio link with amplitude-shift keying signals under conditions of Rice fading. Digital technologies for the implementation of modulation and demodulation procedures are presented. Based on the results of the study, the choice of the decision-making threshold in the demodulator of amplitude-keyed signals in the Rice channel is justified. Proposals for the practical application of the results obtained are formulated. **Keywords:** Rice channel, decision threshold, power of reconstruction error, amplitude-shift keyed signals, signal demodulation

Kryachko M. A., Kryachko A. F., Dvornikov S. V. **Analysis of the possibility of synthesis of spectral effective signals based on atomic functions. PP. 94-98.** The article discusses the results of a comparative analysis of the level of energy localization within the main lobe of the atomic function and the function of the arched sine. General information about atomic functions and theoretical aspects of their formation are presented. Proposals are formulated for the practical application of the results obtained in the interests of the synthesis of spectrally efficient signals. **Keywords:** atomic functions, spectrally effective signals, energy localization

Zubakin I. A. **Application of entropy to the method of aligning histograms of color images. PP. 99-106.** The application of conversion of color images to monochrome images at presentation to the observer is considered. It has been shown that a better uniformity of the histogram estimated by the distribution entropy is achieved by separately aligning the color channels than by aligning the histogram of the resulting black-and-white image. **Keywords:** histogram, luminance channel, color channel, image quality, information quality, entropy

Borisenko E. V., Anoshko R. N., Golubovsky N. P., Zaitcev P. I., Kuruedov S. V., Lazarev M. V., Neronsky R. V., Timashev N. A., Zhurenkov A. G. **Schematic solutions for an atmospheric optical communication line. PP. 107-114.** Schematic solutions for receiving and transmitting channels of an atmospheric optical communication line are discussed in this article. Examples of realization and proposals for their further improvement are given. Proposals are given for their further improvement by selecting a signal-code design for the existing error distributions in an optical channel with AT modulation, by changing the type of modulation from the AT used in the existing version to a more promising FT modulation. **Keywords:** atmospheric optical communication line, receiving channel, transmitting channel