ABSTRACTS

*Yakovlev V. A., Zhurenkov A. G.* **Optical methods for studying natural and technogenic anomalies of the marine environment. PP. 3*–*8.** 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:** optics of natural environments, hydro-optical systems, optical shadow method, radiation pattern, random noise.

### ВОПРОСЫ РАДИОЭЛЕКТРОНИКИ

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### ТЕХНИКА ТЕЛЕВИДЕНИЯ

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*Popov V. V.* **A priori uncertainty and adaptation of lighting in underwater observation. PP. 9*–*22.**The dependences of the image contrast on the distance to underwater objects are experimentally estimated using wide-angle illumination with two types of spectra: white and blue-green. It is shown that due to the fact that the illumination efficiency depends on the spectrum and power of the emitter, these parameters should be controlled adaptively to the observation conditions and the distance to the object. **Keywords:** contrast, backscatter noise, distance

*Sergeyev V. V., Kosyanchuk S. I., Popov V. V.* **Diver's tug with photo and video monitoring system. PP. 23*–*28.** The equipment of divers' tugs with photo and video shooting systems is considered. The technical characteristics of the divers' tug, the structure and main parameters of the equipment for photo and video shooting of objects of observation at the speed of the divers' tug are given. The issues of equipping the system with additional sensors and functions are considered. **Keywords:** diver's tug, underwater work, underwater television, TV camera, LED lighting system.

*Malashin D. O., Malashok E. G.,* *Lesnykh A. I.* **Automatic detection of oil spills by remote sensing of the underlying surface. PP. 29*–*36.**The Research of the possibility of using laser-induced fluorescence in a portable system for automatic detection of oil spills by remote sensing of the underlying surface. The restrictions on remote determination of oil spills using unmanned aerial vehicles are considered. It is proposed to combine multispectral and radar images to increase the probability of determining the oil slick. The dependence of the received power of the laser-induced fluorescent signal and the threshold power on the probing height is presented. **Keywords:** oil spill, multispectral image, induced fluorescence.

*Ivanov V. G., Kamenev A. A.* **Use of polarized own IR radiation of terrestrial objects to increase the contrast of their images. PP. 37*–*45.** The published results of studies on the use of polarized radiation of low-contrast terrestrial objects in the mid-far infrared range (3...15 μm) to increase the possibility of their identification by thermal imaging video polarimeters with matrix photodetectors (MP’s) are considered. In the course of experiments it was found that a higher contrast of elements in the images of terrestrial objects is achieved in the far IR range (8…12 μm), in which the signatures of the observed objects are formed mainly by their own thermal radiation and therefore are more resistant to changes in seasonal-daily and meteorological observing conditions. A significant increase in the image contrast of an object formed by its polarized radiation in this range can be achieved by placing a special microstructure on the photosensitive surface of the MP, which causes resonance between the corresponding mode of the incident radiation and electrons in the MP. **Keywords:** video-polarimeter, identification, infrared range, terrestrial object, detection, polarized radiation

*Gukov S. Y.* **Analysis of experimental data to determine the error of distance measurement during multi-camera shooting with a ToF camera. PP. 46*–*55.**Using the example of the Intel Realsense D455 camera, an experimenttal analysis of the errors in measuring the distance to the object during multi-camera shooting was carried out. The camera was tested in single and multi-camera shooting modes under various external conditions. The problems arising during shooting are shown and analyzed. **Keywords:** 3d modeling, depth camera, intel realsense d455, point cloud, multi-camera shooting, tof camera.

*Rogachev V. A***. Structural and parametric adaptation in optoelectonic detection systems. Pp. 56–66**. The implementation of the principle of adaptation in optical-electronic detection systems is considered. It is found that the maximization of the probability of correct detection for all signal classes is ensured by adaptation. It is shown that a priori uncertainty about the background is overcome by parametric adaptation, and a priori uncertainty about the signal class is overcome by structural adaptation. **Keywords**: optoelectronic systems, [detection](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/detection), modes [of](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/of) [operation](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/operation), [a](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/a) priori [uncertainty](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/uncertainty), [adaptation](https://dictionary.cambridge.org/ru/%D1%81%D0%BB%D0%BE%D0%B2%D0%B0%D1%80%D1%8C/%D0%B0%D0%BD%D0%B3%D0%BB%D0%BE-%D1%80%D1%83%D1%81%D1%81%D0%BA%D0%B8%D0%B9/adaptation)

*Pavlov V. A., Zavjalov S. V., Fyodorov S. A., Shariaty F.* **Application of deep learning methods for synthesis of CT images**. **Pp. 67–75**. The application of deep learning methods for the synthesis of computed tomography images of lungs containing edema is considered. A method based on StyleGAN3 for the synthesis of realistic CT images is proposed. **Keywords:** convolutional neural network, pulmonary edema, COVID-19, computed tomography of the lungs.

*Dvornikov S. S., Gudkov M. A., Ustinov A. A., Dvornikov S. V.* **Algorithm for wavelet transformations of typical images. PP. 76*–*82.**The description of the wavelet transform (WT) based on the mathematical apparatus of linear algebra is considered. Based on the matrix description of the IP, an analysis of the correlation dependences between the conversion coefficients was carried out. The preservation of correlation dependences between the elements of IP submatrices of different levels of expansion has been experimentally confirmed. A conclusion is made about the expediency of the revealed correlation dependencies in the development of arithmetic coding algorithms.**Keywords**: correlation of image transformation coefficients, arithmetic coding algorithms, wavelet transform, decorrelating transformations.

Dvornikov S. S., Ayukov B. A., Kryachko A. F., Okov I. N., Dvornikov S. V. **Spectral efficiency of digital standards radio signals. PP. 83–90.** General approaches to estimating the spectral efficiency of signals, radio standards and protocols are considered. Examples of calculating the spectral efficiency for various modulation formats and modems are given. The main ways and directions of increasing the spectral efficiency are shown. The results of the analysis of the spectral efficiency of the main standards of digital broadcasting television are presented. **Keywords**: spectral efficiency, modulation efficiency, digital television standards

Vlasenko V. I., Dvornikov S. S., Bibarsov M. R., Pogorelov A. A, Dvornikov S. V. **Polarization spacation based on logo-periodic turnstone antennas. PP. 91–97.** The results of the analysis of the possibilities of organizing the polarization separation for ionospheric radio links are presented. The features of polarization fading in channels are considered. The features of the use of turnstile antennas are presented. The results of simulation of radiation patterns for log-periodic antennas with turnstile arrangement of vibrators are demonstrated. An analysis of the efficiency of the polarization separation of antennas under conditions of signal fading has been carried out. **Keywords:** spatial and polarization spacing of antennas, signal fading, ionospheric channel, log-periodic antennas with vibrator turnstile arrangement.

*Flerov A. N., Flerova A. A.* **Linear model of the automatic signal synchronization system of the pulse antenna array. PP. 98–105**. A nonlinear discrete system of automatic signal synchronization (ASS) of antenna modules of a pulsed phased array (PPA) containing a binary time comparator of signals, a time delay modulator of the nanosecond duration range and a digital integrator is considered. It is shown that in the presence of a delay jitter of the antenna modulator output signal, the nonlinear discrete model of the ASS is reduced to a linear one, which makes it easier to determine its parameters in the synchronization mode. **Keywords:** pulsed phased array antenna, spatial synchronization, automatic time synchronization system, linear and nonlinear models of the synchronization system

*Bezuglyi A. M., Ryshov A. S.* **Design features of matrix photodetectors for ultra large focal planes. PP. 106–110**. The article considers the design features of matrix photosensitive devices with charge coupling, intended for operation as part of optoelectronic converters for monitoring and astronomical observations. Presented a comparative analysis of focal planes of various shapes. **Keywords**: charge-coupled device, frame matrices, focal plane.

*Siryi R. S., Baranov P. S.* **Method for evaluating the effectiveness of orbital space debris monitoring systems. PP. 111–120.** The paper analyzes the approaches to evaluating the efficiency of space debris detection and shows the lack of a unified approach to interpreting the results obtained. A method for estimating the detection problem through the metric of the detection probability in the planes of the size of the object and the distance to it is proposed. An assessment of the hardware configuration of computer vision systems for the task of space debris monitoring is given. **Keywords:** computer vision system, space debris, signal-to-noise ratio, object detection, spacecraft.

*Sharivzyanov D. R., Siryi R. S.* **Miniature hyperspectral complex using tunable emission source for archival work.** **PP. 121–127.** The article estimates the need of using of hyperspectral analysis in archival work. The disadvantages of the hyperspectral complex used by the hyperspectral imaging laboratory of Saint Petersburg Electrotechnical University "LETI" for the restoration of fading texts are given. A model of a miniature hyperspectral complex for the analysis of documents by employees of archival committees is proposed, and an assessment of the advantages of using this complex is also given. **Keywords**: text restoration, hyperspectral analysis, hyperspectral complex, hyperspectral lighting system, led

*Serebrjakov D. A., Gareev V. M., Gareev M. V., Kornyshev N. P.* **Features of image formation in a hyperspectral system based on the fabry-perot interferometer. PP. 128–132.** The article considers a hyperspectral system based on the Fabry-Perot interferometer, designed to operate in the visible range of the spectrum. The methods of forming spectral images obtained by adjusting the size of the interferometer air gap using electrically controlled piezoactuators are analyzed. Analytical expressions are given to evaluate the spectral selectivity of the system. **Keywords:** *spectral images, Fabry-Perot interferometer, hyperspectral system*

*Sokolov N. M.., Baranov P S.***Problems of calibration of hyperspectral systems in the analysis of fluorescent objects**. **PP. 133–137.** Methods for implementing a calibration target for shooting in ultraviolet light are presented. Methods of compensation of low sensitivity in the near ultrafio-summer range are shown. Methods for correcting the quantum efficiency and uneven illumination of LED sources to obtain the true spectral characteristics of the tested objects are proposed. **Keywords**: radiometric calibration, fluorescence, calibration target

*Akaeva T.M., Kamenskiy A.V., Strumilova M.A.* **Recursive-separable filter image enhancement. PP. 138–145.** A two-dimensional trapezoidal recursive-separable dual cascade filter for image enhancement is presented. The description of construction algorithm, structural scheme and system function of the developed filter are presented. The research of its performance in comparison with the algorithm of classical two-dimensional convolution is carried out. **Keywords:** digital image processing, two-dimensional filters, recursive filters, performance

*Yakovlev V. A., Zhurenkov A. G.* **Feedback on the monograph «Optical field of the marine near-horizon area for infrared and television devices»**. **РP.** **146–148**. The book was written in the interests of creating multispectral optoelectronic devices, contains extensive reference material on the availability and repeatability of hydrological and meteorological parameters, given for the main water areas.