ABSTRACTS

**ВОПРОСЫ РАДИОЭЛЕКТРОНИКИ**

### серия

**ТЕХНИКА ТЕЛЕВИДЕНИЯ**

**2022 вып. 3**

*Tsytsulin A. K., Bobrovsky A. I.* **Horizons of object discrimination in the spacecraft rendezvous video monitoring system. PP. 3−14**. Boundary ranges (horizons) are considered, at which, as spacecraft approach, it becomes possible to solve the problems of detecting an object, distinguishing its orientation, recognizing an object class and identifying an object in a class. It is shown that the horizon estimates and Johnson criteria are related to the information characteristics of the signals. The use of horizon estimates as a link between the external and internal design of space systems for observing space objects is proposed. **Keywords:** horizons detection, orientation, classification, identification, space video monitoring systems

*Shavin A. S.*, *Krupsky K. A.*, *Kudinov M. G.*, *Isupov A. A*. **Methodological approach to substantiating the requirements for on-board monitoring of man-made space objects, taking into account their geometric and reflective characteristics. РР. 15–24.** A methodological approach has been developed to substantiate the requirements for on-board optoelectronic devices based on modeling images of man-made space objects taking into account their geometric and reflective characteristics. The imaging model is the basis of a methodological approach and is designed to evaluate the capabilities of on-board optoelectronic devices for obtaining coordinate and non-coordinate measurement information. **Keywords**: optical-electronic means, technogenic space object, image formation model, assessment of capabilities

*Pyatkov V. V., Meleshko A. V.* **Adaptation of digital object coordinate meters with variable dynamics. РР. 25–33.** Tracking meters of coordinates of objects with variable dynamics with parametric and structural-parametric adaptation are considered. Based on the considered adaptive systems, recommendations were developed for the use of parametric and structural-parametric adaptation in the operation of tracking meters. **Keywords:** tracking meter, smoothing filter, adaptation, parametric and structural adaptation, tracking error

*Logunov S. V.*, *Fedorenko D. S.*, *Aldokhina V. N.* **Simulation of photometric measurements of an artificial object. РР. 34–45.** The process of converting a light signal into an electric charge during photometric measurements with the help of photoelectric devices is considered. An algorithm for calculating the limiting stellar magnitude recorded by an optical system is described. The sources of initial data necessary for calculations according to the described algorithm are presented. The operation of the algorithm is illustrated by examples of estimating the maximum detection range of an artificial object illuminated by the Sun and calculating color characteristics for the case of two objects with different types of outer shell coatings. **Keywords**: stellar magnitude, color index, photometric system, artificial object, broadband radiation receiver

*Logunov S. V.*, *Korolev V. O.*, *Chernogubov A. V.* **Calculation of the brightness of stars for a typical broadband radiation receiver**. **PP. 46–55.** A technique is described for converting stellar magnitudes from astronomical catalogs made in different photometric systems into a reaction curve system of a typical CCD array. Examples of transformation equations are presented. **Keywords:** reference star, stellar magnitude, color index, astronomical catalog, photometric system, spectral density of energy illumination, broadband radiation receiver

*Denisov A. V.*, *Kutovoy E. Y.*, *Kapitonov D. A.* **Modeling of observation of a geostationary satellite by ground-based optical equipment. PP. 56–68**.Modern computer facilities and software products allow modeling and visualization of various processes, for example, the process of photometry of an artificial Earth satellite using a ground-based optical tool. During the proposed observation, a set of cylindrical, conical, spherical and flat images is assumed. To simulate visual observation, reflection from the surface of an artificial satellite of the Earth, in a visual-spectral study of the lengths of wave-like manifestations, I.G. Lambert and V.T. Phong, estimated determined brilliance depending on the nature of the reflection and the shape of the reflecting surface, as well as methods of theoretical photometry and methods used to model round objects. **Keywords:** geostationary orbit, ground-based optical facility, artificial Earth satellite, photometric light curve

*Rogachev V. A.* **Information contrast of the photodetector signal. PP. 69–84**.The application of information measures to the calculation of the contrast of the photodetector signal is considered. Expressions of the information contrast of the photodetector signal at the Poisson and Gauss distributions are obtained. It is shown that the information contrast for different photodetector modes is determined by a generalized signal-to-noise ratio, which depends not only on the useful signal, but also on the dispersion of signal noises. Taking into account signal noise makes it possible to improve information contrast, i.e. the quality of information. **Keywords:** photodetector, information contrast, dominant information, generalized signal-to-noise ratio

*Kamenev A. A.*, *Romanov V. A.* **Method for substantiation of parameters of ground laser-location stations for detecting of technogenic objects in near-Earth outer space.** **РР. 85–92.** Method for substantiation and selection of the ground laser-location stations (LLS) parameters for detecting and receiving of photometric characteristics of technogenic objects in near-Earth outer space was developed. Laser radiation selected transmitting of different wave lengths in atmosphere was take into account. Using of this method gives possibility of predicting of LLS potential for observing of technogenic objects depending on atmosphere condition (humidity, aerosol) and LLS location. **Keywords:** pulsed laser power, atmospheric transmittance, laser-location station, scattering cross-section, focal plane arrays, near-Earth outer space, technogenic object

*Borisovskaya A. V.*, *Turlikov A. M.* **Methodology for determining the number of sensors in environmental monitoring systems using LPWAN networks.
PP. 93–100.** Environmental monitoring systems using LPWAN networks in the mode of random access to a radio channel are considered. Methodology for determining the number of sensors in such systems is proposed. **Keywords**: sensor networks, environmental monitoring systems, LPWAN networks, random multiple access, sensors.

*Dvornikov S. V.*, *Zhdanov A. Y.* **Synthesis of signals for television based on hexagonal lattices PP. 101–106.** The article presents proposals for the synthesis of quadrature modulation signals for television systems. An assessment is made of the influence of the positioning of QAM signals on their noise immunity. The dependences of the minimum Euclidean distances on the signal position are obtained. Fragments of phase diagrams of QAM -256 signals synthesized by the quadrature method and based on the GEKS-4 structure are presented. Proposals for the practical application of the results obtained are formulated. **Keywords:** noise immunity of signals, quadrature modulation, minimum Euclidean distance, hexagonal lattices

*Antokhin E. A.* **Immunity of narrow-band radar. PP. 107-112.** The article presents an analysis of the features of radar signal distortions that occur in the processing paths. The dependence of nonlinear distortions of narrow-band signals on the nature and type of change in the function of its envelope is shown. The effect of structural interference and Gaussian noise on the quality of radar signal reception has been studied. Analytical and graphic dependences are obtained, which determine the value of the coefficient.**Keywords**: noise immunity of radar signals, narrow-band radars, non-linear signal distortions, structural noise

*Dvornikov S. V., Rusin A. A., Chudakov A. M.* **Analysis of parameters of speech signals of decametric radio communication systems.** **PP. 113–117**. The article presents the results of speech analysis from the standpoint of modulating signals in decameter radio communication systems. An analytical apparatus for calculating the main characteristics of speech signals is proposed. The frequency band for Russian-speaking speech is substantiated, which includes 97,5% of the power spectral density. The simulation results are considered. **Keywords:** speech parameters, speech signal power spectral density, decameter radio communication systems

*Kulikov G. V.*, *Dang Xuan Khang*, *Nguyen Van Dung.* **Noise immunity of signal reception with amplitude-phase shift keying** **in the background of scanning interference. PP. 118–124**.The statistical radio engineering methods have been used to analyze the noise immunity of a multichannel correlation receiver of signals with amplitude-phase shift keying with the ring structure of the signal constellation in the presence of frequency-scanning interference in the communication channel. The dependences of the bit error probability on the signal-to-noise ratio in the radio channel, on the intensity of the interference and its frequency parameters are obtained. It is shown that the influence of interference is most noticeable when it enters the region of the main lobe of the signal spectrum, and even at low interference intensity, energy losses reach 1,5 dB in the case of 16-APSK and 2,5 dB in the case of 32-APSK. **Keywords**: amplitude-phase shift keying, scanning interference, bit error probability, noise immunity

*Ovchinnikov A. A., Fominykh A. A.* **Application of** **low-density parity-check codes in channels with memory. РР. 125–133.** The paper examines the applicability of low-density parity-check codes in channels with memory. The paper investigates the error probability achieved by codes from modern standards in channels with memory with and without interleaving. It is shown that considering channel memory allows getting an error probability less than in the corresponding decorrelated channel in the case of long error bursts. **Keywords**: low-density parity-check codes, channels with memory,channel decorrelation, weight distribution

*Galikeev G. B.*, *Kuzmin D. V.* **Codec synthesis with implementation of linear cyclic code based on FPGA. PP. 134**–**139.** Variants of the formation of a noise-resistant cyclic BCH code (16, 8, 5) are considered. It is shown that the variant of the formation of the BCH code in a systematic form is more convenient for practical use. A block diagram of a digital information encoding and decoding device is given. Calculation tables of code words and error vectors with their corresponding syndromes are presented. **Keywords:** noise-resistant cyclic code, code polynomial, FPGA, microprocessors

*Parshin M. S.*, *Shaldaev S. E.*, *Onufrey A. U.*, *Uryaseva T. A.* **Polarization characteristic of the direction of the vibratory phased antenna array of circular polarization with a wide scanning angle. PP. 140–151**. The article shows the polarization properties of a vibratory phased array when the beam moves in a wide field of view. Theoretically justified, and confirmed in the experiment on the model, the property of stability of the polarization characteristics of the directivity of the radar system in each fixed direction of observation. Numerical simulation is used to show the property of deterministic variability of the polarization parameters of the scanning beam when the scanning angle deviates from the reference direction. The necessity of taking into account the presented properties when developing a polarimetric radar system with a non-mechanical phased array, at the stages of object search and tracking, is justified. **Key words**: polarizing radiation pattern, spatial polarization properties, phased array, beam scanning, cross polarization, polarization distortions, polarization scattering matrix, radar

*Zubakin I. A.* **Classification of users by time-frequency characteristic.** **PP. 152–159.** The task of classifying users by time and frequency characteristics with limitation on the complexity of the classifier and the duration of the speech signal is considered. It has been shown that the effective duration and effective frequency band values can be classified based on a preformed compact representative sample of sounds. Application of dominant information principle to onedimensional signals of sounds corresponding to letters of Russian alphabet is considered. It has been shown that it is useful to use the concept of effective speech duration to extract dominant information. For most letters, the recognition of the spoken sound is experimentally confirmed when limiting the signal duration to the effective duration value. **Keywords:** classification, effective duration, effective frequency band, base, sound quantum, semantic sound quantum

*Motyko A. A., Tsytsulin A. K.* **Review of the collective monograph "Neurotechnologies" edited by Yu. E. Shelepin and V. N. Chikhman. PP. 160–163.**

*Lykova Е. М*. **To the 100th anniversary of the birth of Yu. K. Khodarev**. **PP. 164–166.**