

DOPPLER DIRECTION FINDER WITH J-CORRELATION PROCESSING (p. 4-8)

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The paper considers one of the types of a phase direction-finding method - a Doppler single-channel method. Despite of many publications on this issue, a number of important features in the direction-finder operation have not yet been disclosed. In this regard, the comprehensive analysis of signal processing in the direction-finder is conducted, and features of its processing are defined in the paper. It is shown that the presence of statistical relationship of spectral components in the processed signal and the use of J-correlation signal processing eliminates the effect of instability of the phase characteristic of line channel on the result of measurement by the direction-finder.

The requirements to the band-pass filter emitting the signal of correlation processing are defined. An exact expression of the output voltage of the direction-finder is obtained, from which the requirements to the correlation detector are defined. The possibility of direction-finder operation both on even and odd harmonics of the antenna rotation frequency is proved. The ways of optimizing the structure of the signal spectrum at the detector output to highlight the required spectral component, containing information on the angular position of the radiation source, and providing the specified measuring accuracy are shown

Keywords: modulation index, spectral component, time delay, Bessel function, correlation detector

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X-SHAPED DIFFUSER-SUMMER OF SIX-PORT CONVERTER OF VECTOR NETWORK ANALYZER (p. 8-14)

Volodymyr Karlov

Two designs of 12-pole measuring converters were studied in the paper, in which the E-plane waveguide X-shaped power divider and four directional detectors are used.

In the first converter design, the X-shaped divider is loaded in a measuring port directly on the studied two-pole network, and three scalar panoramas measure the reflection coefficient and two attenuation coefficients.

The basic parameters of the mathematical model allow realizing the advantages of the six-port converter. The main source of the measurement error refers to the "operation" of scalar panorama, located in the input port of the divider, in a standing wave mode. The constructed mathematical model reflects the properties of magnetic Hertz vector dispersion over a scalar four-port discontinuity of the divider.

In the second converter design, the supporting directional detector is replaced from the input port to the measuring channel between the divider discontinuity and studied two-pole network, and adjusted to the output wave power. In the mathematical model of the six-port converter there are no re-reflections which arise in the measuring port; though the centers of three circles on a geometrical model lie on the same line that is the lack of this design. The obtained mathematical model of the converter corresponds to the model of the converter-summer of the input wave.

As can be seen from the conducted experimental studies, the error of measurement of the complex reflection coefficient of two designs of vector panoramas is at the level of 10%

Keywords: vector network analyzer, four-port discontinuity, reflection coefficient

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MODIFICATION OF SCHNORR AND OKAMOTO PROTOCOLS ON ELLIPTIC CURVES (p. 14-18)

Alexey Onatskiy

One of important issues of information security in the interaction of users is the use of methods and tools, allowing one party to make sure of the authenticity of another party. The proof of knowledge protocols which have the additional property of zero-knowledge are applied to solve this problem. The protocols based on asymmetric encryption have received wide acceptance, such as the Fiat-Shamir, Schnorr, Okamoto, Guillou-Quisquater, Brickell-McCurley, Feige-Fiat-Shamir protocols. Cryptographic strength of these protocols is defined by discrete logarithms in a finite prime field, as well as an increase in the number of accreditation cycles. As a result of the development of methods and tools of cryptanalysis and rapid development of technologies and power of computing systems, there is a need to increase the sizes of system-wide parameters of the protocol, leading to increased resource intensity and performance complexity of basic operations in the fields.

Cryptographic zero-knowledge protocols on elliptic curves are proposed in the paper. The strength of cryptosystems on elliptic curves is based on the difficulty of solving the discrete logarithm problem in the group of elliptic curve points, and is more difficult than the discrete logarithm problem in the finite field. The completeness and soundness of protocols were determined, computation examples were given. The tools of the Strength Protocol Animator package were applied to verify the protocols for resistance to enemy attacks. Consequently, the use of cryptographic protocols on elliptic curves will significantly reduce the sizes of protocol parameters and increase the cryptographic strength

Keywords: cryptographic protocol, elliptic curves, identification, authentication, correctness, zero-knowledge

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THE ESTIMATION SYSTEM OF HUMAN EMOTIONAL STATE ANALYSIS BASED ON THE GALVANIC SKIN RESPONSE (p. 18-21)

Olga Kyselova, Tanya Soroka

The paper describes an algorithm of development of the hardware and software that determines the level of emotional stress of a person on the basis of galvanic skin response. To investigate the emotional

state in response to stimuli of different types, the system for registration and analysis of galvanic skin response has been developed. The galvanic skin detector can be attached to any part of the body. Usually, it is attached to fingers of hands or feet. The conductivity of the skin depends on the amount of perspiration segregated in the area under the attached electrodes. This pattern is used to diagnose various dysfunctions such as an epileptic seizure. The sweaty hands can be considered as a warning in this case. Galvanic skin response provides with data of the human state, which are independent on the subjective feelings of the patient. The software of galvanic skin response analysis has been developed by using NI LabVIEW.

Further research includes the development of algorithms for the analysis of emotional states by improving this system with additional types of monitoring, such as registration of the pulse wave, respiration monitoring etc

Keywords: emotional state, hardware and software system, galvanic skin response, NI LabVIEW, NI ELVIS

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NONLINEAR OSCILLATIONS OF FLOAT SUSPENSION UNDER THE N-WAVE. CYCLIC LOADING (p. 22-25)

Vladislav Shybetksij

The paper deals with the study of the interaction of sensitive sensors of the navigation system of hypersonic aircrafts with powerful N-wave during flight operations. The paper outlines that the dy-

dynamic action that is penetrating acoustic radiation can be provided in the form of Fourier series along the coordinate φ . The triorthogonal coordinate system attached to the fuselage of the hypersonic aircraft was constructed, and the diagram of Euler angles was given. For cyclically deformed state, the formulas for determining the coordinate functions of displacement of the cylindrical part of the surface of the float gyroscope suspension, which is subjected to the influence of a plane monochromatic wave and diffuse field are proposed. The formulas for calculating the value of disturbing pressures acting on the sensors of the gyro-stabilized platform at overcoming the sound barrier were derived. The projections of the angular velocities on the axis Oxyz for three gyroscopes of the navigation system were considered

Keywords: float gyroscope, N-wave, elastic displacement, hypersonic aircraft

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STAGES OF CREATION OF COMPUTER SYSTEM OF PREOPERATIVE PLANNING OF SURGICAL CORRECTION OF SQUINT (p. 26-31)

Dmitriy Kukharenko, Oleg Avrunin

The paper is devoted to the development of the computer system of preoperative planning of surgical correction of the oculomotor system taking into account the whole complex of muscles.

The survey of existing models of oculomotor system was conducted. The method of determining the coordinates on the eyeball model surface and the method of calculation of the force moments of the oculomotor muscles on the eyeball model surface were developed, which are connected in the computer system, which takes into account biological parameters of the person.

The software feature is a three-dimensional visualization of the eyeball with the display of the main groups of muscles and acting moments.

The comparative analysis of the obtained results of preoperative planning of surgical correction of the computer system with the results of ophthalmologist's planning was carried out. The results of the analysis showed the adequacy of the proposed model and efficiency of the developed methods.

It was proposed to use the computer system, which increases the effectiveness of surgical intervention by 27% in preoperative surgical planning. The computer system considerably reduces the time

the patient is under anesthesia, due to the prompt and convenient obtaining of the necessary calculations

Keywords: oculomotor system model, computer system, preoperative planning

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THE CONCEPT OF DESIGN OF MULTIPURPOSE TETHERED UNDERWATER SYSTEMS WITH THE CENTRALIZED DATA EXCHANGE (p. 31-35)

Olexandr Blintsov

The structure and design features of a typical tethered underwater system are given. The design complexity, limitations on the installation of additional equipment and the need for the creation of multi-purpose tethered underwater systems are shown.

Logic modules, of which almost all tethered underwater systems consist: actuating mechanisms and sensors of the underwater robotic vehicle, control and display devices of the control station, documenting devices, are singled out.

The concept of creating multi-purpose tethered underwater systems is developed, which allows their prompt modification at the stages of design and operation. The modular construction of the tethered underwater system with the centralized information exchange for the implementation of the developed concept is proposed.

Application of the developed concept allows to integrate modern systems of automatic control into the tethered underwater system, perform full information documenting, realize remote and multi-agent control, apply satellite and network-centric technologies, study the prototypes of the latest specialized attached implements

Keywords: concept, tethered underwater system, modularity, centralized information exchange

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COMBINING REDUNDANT INFORMATION FOR SPATIAL ENVIRONMENTAL MONITORING (p. 36-39)

Yuri Kulyavets, Oleg Bogatov, Elena Ermakova

Availability of information redundancy allows obtaining a total estimate by various relatively simple measuring instruments using a minimal sufficient set of primary measurements. The analysis of the known methods for solving this problem shows that the highest emphasis is placed on identifying the influence of measurement redundancy on the accuracy of estimates, and the problem of finding optimal algorithms of combining the estimates, in general correlated, is not considered. The algorithm of indirect estimation of the state vector based on the estimates of the observation vector is well studied. Along with this, the estimated parameters are, as a rule, associated with the nonlinear functional relations measured to initial estimates. Therefore, the direct use of the maximum likelihood method leads to the necessity of solving systems of nonlinear equations. It is possible to use two different approaches: linearization of nonlinear functional relations and iterative method (method of successive approximations). Herewith, the main advantage of the linearization method is that it allows obtaining the optimal (in this case the maximum likelihood) estimates of total parameter and correlation matrix of estimation errors in an explicit form. On this account, it is shown that the solution of the problem of the optimal use of estimates of the same state vector, obtained by various methods at the same time, is reduced to the consecutive application of the algorithm of estimates filtering.

Thus, the optimal rule of finding of the total estimate and its accuracy is obtained. This rule, characterizing the measurement of the current parameter, is structurally similar to formulas for obtaining estimates with an account of the pre-experimental data, but significantly differs by the methodology of their obtaining

Keywords: combination of information, measurement of parameters, independent measuring instruments, filtering of estimates

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TO THE QUESTION OF SOLVING THE ATTITUDE DETERMINATION PROBLEM (p. 40-44)

Lev Ryzhkov, Dmytro Stepurenko

Deterministic methods of the attitude determination allow to determine the angular position of the aircraft based on the information on several reference directions, existing in space. The parameters, used for the attitude description in such methods are the attitude matrix, quaternion, Rodrigo-Hamilton parameters. However, in practice it is convenient to use Euler angles, which have a simple geometrical interpretation. The method, proposed in the paper allows to determine not the entire attitude matrix, but only its necessary part, on the basis of the accepted sequence of turns. The matrix, which is calculated on the basis of vectors in the coordinate reference system and is used for the calculation of the attitude angles during the certain time, can be considered invariable that allows to simplify calculations. Also, the paper proposes to apply the orthogonalization to the direct solution of the system of equations, which connects vectors of reference directions in two coordinate systems. The proposed methods are simple in implementation, but less accurate than existing methods, using the least squares criterion during the determination of attitude parameters. The indications of the measuring instrument with the lowest accuracy have the greatest influence on the accuracy of the obtained estimates

Keywords: attitude determination problem, orthogonalization, least squares criterion, model of measurements

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INTEGRATED SYSTEM OF NAVIGATION INFORMATION MEASUREMENT FOR FLIGHT CONTROL SYSTEM (p. 44-55)

Kostiantyn Ponomarenko, Lev Ryzhkov

The integrated system for the measurement of movement parameters, constructed on the basis of a tightly coupled scheme of integration of inertial and satellite navigation systems is considered in the paper. The main objective is the improvement of the measurement accuracy of navigation information and ensuring the measurement of movement parameters in conditions when each separate system does not provide sufficient accuracy for practical tasks. The applied algorithm for recursive estimation of errors of resultant integrated navigation system allows real-time correction of indicators of inertial and satellite navigation systems, that leads to the increase of the measurement accuracy of navigation parameters.

This paper shows the dependence of the achieved effect of the increased accuracy on the nature of movement, arrangement and number of satellites, and also trajectory orientation relative to the satellites, signals from which enter the receiver of satellite navigation system. The proposed algorithm can be used in the aviation industry, in guidance and flight control systems, and also onboard information-measuring systems of aircrafts, operating in the presence of radio frequency interference

Keywords: SDINS, SNA, tightly coupled integrated navigation system, mathematical model

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PECULIARITIES OF GROUP CONTROL OF AUTONOMOUS UNDERWATER VEHICLES DURING EXECUTION OF SEARCH OPERATIONS (p. 56-60)

Sergiy Blintsov, Tchy Doan Fuck

The features of control of the group of autonomous unmanned underwater vehicles in conditions of the uncertainty of the environment and own technical characteristics of underwater vehicles were considered. The generalized structure of the five-level system of group control of autonomous unmanned underwater vehicles was developed, which includes the level of megacontrol of several groups of vehicles, levels of strategic, tactical and local control of the group of underwater vehicles, level of quality control of group control of vehicles. The main tasks of the organization of the automated control of groups of underwater vehicles were formulated, which include the formation and support of spatial configuration of the group, flexibility of the group structure during the execution of underwater mission, navigation safety, reliability of internal communications of the group of vehicles and their search characteristics. The specializations of separate underwater vehicles and separate groups of vehicles were proposed for the solution of underwater search problems, problems of communication between the vehicles themselves and the base, problems of ensuring navigational safety at the group use of underwater vehicles

Keywords: maritime search operations, autonomous underwater vehicle, group control, control system

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APPROACHES TO SOLVING THE PROBLEM OF NETWORK COMMUNICATIONS TRAFFIC MONITORING AND PROCESSING OF ITS RESULTS
(p. 60-64)

Rostyslav Skrypuk

The development of computer networks in the IT industry passes very quickly, trying to satisfy constantly increasing demand for fast and high-quality connection to the global Internet network. That is why, there is a need for the development of the specialized software (sniffer), which would simplify the work of system administrators in debugging of networks and would allow less competent experts in this sphere to start performing such work.

The analysis of the systems of analogues, which have a number of disadvantages, the main of which are the presence of console

interface only and difficulty of use because of the increased requirements for the user's knowledge in the field of network technologies was conducted.

Some of them support Linux systems only, that makes them unsuitable for the use on most desktop computers. The considered systems do not have the realized construction of graphical results that could be quite a valuable tool in the study of networks. Therefore, there is a need for the development of the specialized software, which would simplify the work of system administrators in debugging of networks and would allow less competent experts in this sphere to start performing such work.

The analysis of approaches to the solution of the problem of network traffic monitoring and processing of its results was carried out. Modern network systems and problems, which arise in the study of their condition, were considered.

As a result of the analysis of existing methods for the study of network systems it was proposed to use the method of listening to the network interface as the way of the study of network systems for further system administration

Keywords: sniffer, network systems, administration

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