AMBIENT TEMPERATURE-INVARIANT HOT-WIRE ANEMOMETERS FOR THE CONSTRUCTION OF GAS METERS (p. 4-10)

Irina Obukh, Yuri Yatsuk, Taras Oleskiv

Today the problem of natural gas use is especially acute in Ukraine since highly energy-intensive and morally and physically obsolete gas consuming technologies are used in everyday life and in almost all industries. Quality indicators of gas meters, used in Ukraine largely do not meet modern requirements because of low metrological characteristics and the inability to fulfill the requirements of many regulations in them. One of the major tasks in solving this problem is the accurate accounting of natural gas in the industrial and residential areas. The purpose of this paper is to develop proposals on improving construction methods of natural gas meters with improved metrological characteristics. Therefore, an analytical review of existing construction methods and tools of domestic gas meters is conducted. The methods for constructing high-accuracy hot-wire anemometric gas meters are proposed. The structure and static characteristic of the hot-wire anemometer transformation are given, the conditions for ensuring the invariance of the function of the hot-wire anemometer transformation to changing environmental conditions based on error analysis are proposed. The results of experimental studies of the hot-wire anemometer model for creating domestic gas meter are analyzed. In order to reduce the meter error it is proposed to use sensors based on p-n-junction for constructing hot-wire anemometric gas meter since temperature sensors based on p-n-junction are promising for measuring means of heat quantities and such sensors are able to work in a fairly large temperature range x.

Keywords: gas meter, hot-wire anemometer, static characteristic, transformation function invariance, ambient temperature.

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METHODS OF MONITORING MOTION PARAMETERS OF WINDERS (p. 10-14)

Vitaliy Larin

The paper considers the shortcomings of existing selsyn sensors, used in the monitoring and control system of winder for measuring the speed and depth of the cage. To eliminate the disadvantages of the existing control method of the specified motion parameters, two new parameter measurement methods – both suggest using non-contact measurement method based on ferromagnetic transformers, belonging to the group of electromagnetic transducers are proposed. The first method can be applied at the coal mining enterprises with the ground mounting of winder; the second method is versatile since it can be used in both ground, and tower (copra) mounting of the winder. These methods differ in the mounting place of the transducers. In addition, implementing the second method require using an additional structural element of the measuring channel of the system – belts with driving elements. Implementing the proposed mounting methods allows to improve the measurement accuracy of both speed, and depth of winder due to eliminating the influence of backlash on the measurement process, and increase the longevity of the measurement subsystem by using the non-contact method that will allow to extend the service life of transducers.

Keywords: ferromagnetic transformer, winder, speed, depth.

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THE SUSPENSION CHARACTERISTICS DATA OBTAINING TECHNIQUES BASED ON IMAGE PROCESSING (p. 15-20)

Dmitry Antonenkov

At present, special attention is paid to creating new technical means and information technologies for the aquatic environment control.

Technical means for obtaining information about the parameters of suspended matters in seawater were discussed in the paper. The developed method, allowing simultaneously obtain data on the concentration and size composition of suspended matters in seawater using image processing of environment was described. Using electro-optical converter as an electronic shutter allows to obtain the necessary exposure time to register the processes with high temporal variability.

The description of the working procedure of the developed specialized stand, designed for laboratory testing and calibration of technical means, used for determining the suspension characteristics was given. Using the special bottom material resuspension technology has allowed to obtain the conditions for the experiments that are close to reality in terms of the bottom material suspension process dynamics.

The data the on size composition and concentration of the suspension, obtained during laboratory testing of the designed technical means were given.

The studies allow to create the technical means that are able to rapidly determine the parameters of water-suspended matters of bottom sediments in natural conditions.

The developed specialized test stand allows to perform adjustment and calibration of various instruments, used to determine the parameters of suspended matters, in particular suspension traps, directed light attenuation coefficient meters (turbidimeters), hydroacoustic suspension geometry tools (meters of vertical distribution of the suspension concentration).

Keywords: technical means, suspension concentration, particle size composition, sediment transport, images.

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COMPENSATION OF DYNAMIC ERRORS OF VIDEO IMAGES WITH MEASURING INFORMATION BASED ON ARTIFICIAL NEURAL NETWORKS (p. 21-26)

Yuriy Podchashynskyi, Oksana Shapovalova, Yurij Shavurskiy

Algorithmic methods of compensating the dynamic video image errors with measuring information were considered. For example, it can be a video image of industrial products made of natural stone. These products need to be accurately controlled by the geometric parameters, which define the quality and aesthetic appearance of the product (linear dimensions and angles of the outer contour and geometric parameters of the structural elements of the finished surface). When forming the video images, dynamic errors appear which affect the accuracy of the geometric parameters of the products. These errors are caused by a non-ideal optical system of a video image forming device (the influence of a scattering point function) and the products movement in relation to the device during the manufacturing process (blurring of contours in the video). It was proposed to use an adaptive linear neural network for compensating

the dynamic errors. The neural network implements a filter that restores a video image, improves the playback quality of the product contours and accuracy of their geometrical parameters. Weighting coefficients of the filter are adjusted by training the neural network in accordance with the current parameters of the video image dynamic distortion. This improves the accuracy of determining the geometric parameters in the production conditions of measurements.

Keywords: geometric parameters, video image, dynamic errors, error compensation, artificial neural network.

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WINDOW CORRECTION AT TIME SERIES REALIZATION OF THE NARROW-BAND GAUSSIAN STOCHASTIC PROCESS (p. 27-32)

**Anatoly Velychko, Dmytro Velychko,
Aleksey Vichkan, Kostyantyn Netrebenko**

The paper deals with forming random realizations of a narrowband, stochastic stationary process as time functions on the interval, limited by the received signal duration. Independent values of the envelope and phase functions are used during the formation. For them nodal points with a uniform and the Rayleigh distribution are defined by the multiplicative congruent method. They are set within the given interval at distances greater than the correlation interval. Intermediate points are determined using a widely used spline interpolation. Herewith, there are values that go beyond the theoretical distributions of the amplitude and phase. Using the Hanning window function, the correction of random functions in these areas is introduced. This allows bringing the distribution of the envelope and the phase of the generated realizations to the theoretical laws. The statistical properties of the generated realizations before and after the window correction are studied.

Keywords: pseudo-random sequences, narrowband signal, envelope method, modeling, statistical radio engineering.

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MOVING OBJECTS RECOGNITION METHOD BY THEIR VIDEO IMAGES (p. 33-37)

Mikhail Anokhin

Modern computer systems have sufficient capacity to significantly improve the efficiency of the image recognition system. These opportunities allow to prevent man-made disasters and social conflicts, so this area of research is in demand in the contemporary community. Systems in most cases have a modular structure, and feature-

formation and decision-making modules are one of the most important components. A brief analysis of existing methods was given in the paper, and promising directions for developing own solutions of the problem were selected. Feature-formation method is based on using the orthogonal transformation of the spatial spectrum of the video image, which allows to eliminate the effect of some deformations on the recognition quality, as well as to reduce the set of features, used in the decision-making. Since the set of features is represented by the eigenvectors, the decision rule construction algorithm is based on using the Dice similarity criterion. This criterion was chosen because it has allowed to more qualitatively compare the feature vectors of the input image and the image from the database. The results of performance evaluation of the recognition system prototype were given. In the future, using large data arrays in order to optimize the system and increase the evaluation reliability of its quality characteristics is expected.

Keywords: recognition, feature, Fourier transform, eigenvectors, decision rule, Dice's coefficient.

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RECONSTRUCTION METHOD OF THE INTACT SURFACE OF SURGICAL ACCESSES (p. 37-41)

Maksym Tymkovych, Oleg Avrunin, Husham Farouk Ismail

The developed construction method of the intact surface of surgical accesses and its visualization for the problems of planning stereotactic interventions on the human brain is described in the paper. This representation allows to combine the surgery risk estimates with the patient's skull geometry, thereby ensuring a reasonable choice of surgical access by surgeon-specialist.

The method consists of the reconstruction of the object, on which the surgeryrisk data is further directly applied. A distinctive feature of the reconstruction method, described in the paper is that the construction of a geometric object is made based on surgical accesses. Also, due to using connectivity of vertices obtained during reconstruction, filtration of the resulting geometry without the need for additional transformations is possible.

The research results can be used to create the neurosurgery planning system that will allow to reduce the mortality rate of the human brain surgeries.

Keywords: stereotaxy, neurosurgery, surgical access risk, risk map, polygonal surface reconstruction.

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BUNDLED SOFTWARE DEVELOPMENT FOR CONCURRENT CARDIAC PERFORMANCE MODELING (p. 42-46)

Bogdan Yeremeev

Tasks of timely identification and correction of cardiac disturbances are associated with searching for quantitative laws of changing hemodynamic and electrical parameters, as well as with the analysis of asynchronous concurrent processes and their interaction. To solve this problem, it was proposed to use specialized modeling complex with a combined model of the heart, which is a graphical-analytical model of the heart, where certain graphical elements are described by local empirical models.

In this case, the built-in mobile solutions, based on Android operating system were proposed to useas a platform for the software implementation, which provided easy integration into existing or newly developed diagnostic systems.To simplify the process of construction and interpretation of the parameters of the studied object, it was proposed to use hierarchical approach, using the opportunity to accommodate submodels in peaks of macro-transitions. Herewith, activation of such a transition is characterized

by performing a session of submodel, accommodated in it. This approach has allowed to form a layered structure with indicating inter-level relations, having ensured the adaptation of the model to changes in the level of detail. A study design that displays the processing and interaction of the input signal with graphical-analytical level of the cardiac performance model with further output of the results was presented in the paper.

Development of the «Heart Expert» modeling complex will enable the construction, operation and testing of the created models. Thus, we have got an opportunity to distribute the computational and functional parts of the model, with individual adjustment of their parameters and implementation. This simplifies the process of constructing and analyzing the models of complex physiological systems of the body, thus providing a unification of the model creation at all its levels.

Keywords: Petri nets, concurrent processes, modeling complex, combined dynamic model of the heart.

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OBJECTIVE EVALUATION OF NASAL BREATHING BASED ON RHINOMANOMETRIC DATA (p. 47-51)

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Currently, there are many objective diagnostic methods for nasal breathing difficulties. The main conventional method in otolaryngological practice is active rhinomanometry. The value of nasal resistance is considered as a diagnostic parameter of active anterior rhinomanometry. However, the results of the rhinomanometric measurements depend on race, age, gender, body mass index, and growth, etc. Thus, there is no evaluated criterion of physiological norm of nasal breathing according to the data from rhinomanometric studies. This fact significantly complicates the process of diagnosis and reduces diagnostic efficiency of rhinomanometry methods. For solving this problem, it is proposed to use additional spectral estimation data of the rhinomanometric studies using the modified covariance method. For this purpose, the spectral estimation software module is added to the software and hardware for rhinomanometric studies. The use of an advanced hardware and software system for rhinomanometric studies in clinical practice allows improving the diagnostic value of the active anterior rhinomanometry method.

Keywords: rhinomanometry, spectral analysis, modified covariance method, differential pressure, air flow rate.

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INCREASING THE EFFICIENCY OF HARMONIC GENERATION BY NONLINEAR SCATTERERS (p. 51-58)

Anatoly Luchaninov, Dmitry Gavva, Salman Rashid Owaid

Scatterers, which have the elements with nonlinear properties (nonlinear scatterers (NS)) in their structure

were considered. Primary attention is paid to NS, used to implement the antennas with frequency multiplication. For them, the main requirement is increasing the NS emission efficiency by any of the selected harmonics. The aim of the research was to find technical solutions of NS that, by choosing the design and parameters of the emitter, would ensure efficient conversion, required directional characteristics and easy implementation of NS.

It was shown that for series Schottky diodes, operating in the resistive nonlinearity mode, at changing active resistance of the emitter within (25 ... 800) ohms, maximum conversion factor will be the achieved in the case when the ratio of the emitter active resistance on the second harmonic to the resistance on the first harmonic is within 0,25....0,5. For diodes, operating in the capacitive nonlinearity mode, values of the active component of the input resistance of the NS emitter at the fundamental frequency, at which the conversion factor reaches a maximum, should be of about 5...20 ohms, while at the second-harmonic frequency, the resistance should be 2...4 times less than at the excitation frequency.

By selecting the type of the emitter and its geometrical dimensions, it was shown that it is possible to create both single NS and lattices based on them with the conversion factor, close to the maximum possible for nonlinear elements, used in them (the value of the conversion factor of nonlinear scatterer of about 90 % was obtained in the frequency doubling mode for the capacitive nonlinearity mode).

It was shown that NS, based on emitter with displaced feeding point, with a slight loss in the value of the conversion factor compared to the NS, based on more complex emitters provide good performance of large-aperture grids of antennas-multipliers in the broad sector of scanning angles.

It was concluded that by selecting the type of the emitter and its size it is possible to create both single NS and lattices based on them with conversion ratio, close to the maximum possible for nonlinear elements, used in them. This allows to simplify the design of the NS grids, having excluded additional matching and filtering devices.

Keywords: nonlinear scattering, nonlinear element, conversion factor, stray emission, emitter.

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ABOUT THE SENSORLESS MOVEMENT SPEED CONTROL OF MINE ELECTRIC LOCOMOTIVES (p. 59-63)

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Questions of the control of speed of the mine electric locomotives with the purpose of increase of traffic safety on the underground transport are considered in the article. Noted that the rate should limit on dangerous sections of the route. This requires effective and reliable speed control device.

Analysis of existing speed, which uses relationship with the rotating elements of the traction electrotechnical transmission of electric locomotive is conducted. Peculiarities and deficiencies produced at the present time the speedometer with a Hall sensor, mounted at the gearbox electric locomotive. The analysis showed that produced the speed gauge is not able to ensure reliable operation, bringing most of the locomotives are operated without speed indicators.

Authors proposed to ensure high reliability of the speedometer to apply sensorless speed control by using only the electric parameters of traction engines, such as rotor voltage and load current that uniquely identifies the speed. Calculation method for speed electro-mechanical characteristics with acceptable accuracy. Structural diagram of the speed gauge to measure and display the speed of the locomotive is given in the article. Sensorless the speed gauge is easier to manufacture and installation, maintenance, much more reliable, can reduce costs and increase the safety of operation of electric transport.

Keywords: mine electric locomotive, control, sensorless the speed gauge, reliability, electrical parameters, sensor.

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