ABSTRACT AND REFERENCES

INFORMATION AND CONTROL SYSTEMS

MATHEMATICAL MODEL FOR RESOURCE ALLOCATION IN TDMA-BASED WIRELESS MESH-NETWORKS (p. 4-9)

Oksana Yevsyeyeva, Al-Azzawi Essa Mohammed

Wireless mesh-networks that are based on Time Division Multiple Access (TDMA) are preferable from viewpoint of quality of service especially for delay sensitive-traffic such as voice and video.

Since the mechanisms for the guaranteed quality service provision are not defined by standards, the mathematical dynamic model of the mesh-networks is offered in this paper. The model provides an optimal solution for joint routing and link resource allocation problem within the selected class of service. The model takes into account the user's quality requirements, limited amount of link and buffer resources, the interference phenomenon and allows reusing slots on the link layer in order to improve effectiveness of network in general. Because time slot is unit of link layer resource the article introduces effect that order of allocated slots within the route has on end-to-end delay.

It was shown that each slot reusing along a route causes end-to-end delay growing in it. In this regard, the objective function of formulated optimization problem has been modified by the insertion of an additional component that is related to sequence order of slots along the path.

Keywords: wireless mesh-network, quality of service, time-division multiple access, resources allocation.

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METHOD OF IMPROVING THE CAPABILITIES OF STEREO RELATIVELY MOVING THE LISTENER IN LISTENING AREA (p. 10-15)

Sergey Poroshin, Viktoriya Usik, Ihor Bielikov

Increasing the interactive human involvement in the process control is one of the trends in developing modern multimedia systems. Using active stereo and controlling the stereo sound system in a listening area in real time is an understudied field at the present moment. The Microsoft Native Interaction technology enables detecting the human body in the area, capturing and tracking his movements.

The OpenNI algorithm converts human movements into a series of three-dimensional coordinates. These data can be used as a control signal, which makes adjustments to the phase-frequency and amplitude-frequency properties of the audio signal for each loudspeaker channel. That greatly enhances stereo playback capabilities in modern computer games, listening to music or watching videos.

The structural diagram of the sound pressure automated control system, amplitude-frequency and phase-frequency properties in the stereo loudspeaker system is proposed.

It amplifies the perception of the phantom image, which is emitted from loudspeakers, enhances the interactive human presence effect.

Keywords: OpenNI, stereo sound, Microsoft Kinect, phantom image, Native Interaction, interactive technologies, multimedia technologies.

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MEANS OF MILK LEVEL MEASURING FOR PORTABLE FARMYARD MILKING MACHINE (p. 16-22)

Volodymyr Kucheruk, Yevhen Palamarchuk, Pavlo Kulakov, Tatiana Gnes

Theoretical study of the photoelectric converter of light flux into voltage based on a pair of photodiode-operational amplifier is conducted. It is proved that the output voltage of the photoelectric converter based on the pair of photodiode-operational amplifier linearly depends on the illuminated area of the photosensitive photodiode layer.

A primary measuring converter of liquid level based on the considered photoelectric converter, in which the area of the illuminated photosensitive photodiode layer linearly depends on the level, and thus its output voltage are a linear level function, is proposed. Based on the proposed primary measuring level converter, a means of milk level measuring for a portable farmyard milking machine is implemented.

The algorithm for its operation and algorithms for indirect measuring of milk yield, milk ejection intensity, latent period duration and other zootechnical animal parameters are considered. Absolute methodical error of measuring conversion of level and the absolute error of the proposed means of level measuring are determined.

Modern means of individual milk yield measuring for farmyard milking machines, unlike stationary measuring means for milking parlors do not provide the accuracy, necessary for calculating and predicting certain zootechnical parameters. Therefore, measuring means that provides metrological indicators, similar to equipment, which is used in milking parlors, is created.

As a result of implementing the created measuring means, the accuracy of indirect measuring of milk yield is increased, as confirmed by results of experimental studies.

As a result of increasing the measuring accuracy of individual milk yield on farmyard machine, there is the possibility to abandon time-consuming procedure of control milking. Besides, accuracy of indirect measuring of other zootechnical animal parameters and further milking process optimization increases.

Keywords: milk level, measuring level converter, portable milking machine, mechanical milking.

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DATA FLOW CONTROL PARADIGM AND ITS GRAPHICAL REPRESENTATION IN SYSTEM ORIENTED ARCHITECTURES (p. 22-29)

Kostiantyn Kharchenko

A method of representing the architecture of information systems using a data flow paradigm is given in the paper. A graphical form of representing the operation of information systems is worked out.

It can clearly and effectively describe complex interactions between components of the SOA systems in a convenient and simple way. An XML format of describing the data flow architecture in SOA is developed. A method of compiling this representation in OOP languages is proposed. The possibility of generating a parallel-executable code and organizing a unit testing system by means of applying graphic description is considered.

The proposed method of graphic description of SOA-based information systems, unlike UML diagrams allows compiling into an executable parallel code.

As a result of the studies, the methodology of graphic description of cycles and recursions in data flow systems, oriented onto SOA systems, is defined. The method of graphic description of the data flow validation process is developed.

The practical application of such method of describing architecture can be carried out along with various programming languages and can effectively solve problems in the field of enterprise information systems using a service-oriented architecture, image processing, analysis of high-volume data, and control systems.

Keywords: SOA (System Oriented Architecture), data flow, architecture of information systems.

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BIOFUELS TEMPERATURE MEASUREMENT ERROR IN TERMOANEMOMETRICAL FLOWMETERS (p. 29-35)

Yuriy Shavurskiy

The paper considers the measurement of biofuel temperature error, which is based on using a thermoelectric converter in thermoanemometric flowmeter. Quantitatively, these measurement errors were expressed by a mathematical model. Therefore, for more efficient use of thermal converters, necessary calculations of TAF errors were carried out, and the analysis of the feasibility of this TAF was conducted. As a result of the studies, measurement accuracy and performance, which ensures a continuous real-time measurement process were determined. A new mathematical model of thermoanemometric flowmeter errors was developed, and analytical expressions for calculations of its basic errors were obtained. Therefore, to improve the flowmeter accuracy, more sophisticated algorithmic procedures (approximation of biofuel temperature measurement results based on the least squares method and applying artificial neural networks) were used.

This ensures measurement accuracy of volumetric motor fuel flow rate of 1.0...1.5 % at the heater temperature measurement accuracy of 1 %. Using a set of thermal methods and creating new flowmeter structures allow to make biofuel flow rate measurements fully automated with high accuracy and performance.

Keywords: biofuel, thermoanemometer, tachometer, electric converters, thermal converter, diffmanometer, pipeline, meter, temperature sensor, sensitivity.

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SENSITIVITY OF AN ACOUSTIC EMISSION TO WEARING OF SURFACES OF A COMPOSITE MATERIAL (p. 35-41)

Sergiy Filonenko, Tatiana Nimchenko

The results of studying friction and wear of the surfaces of the composite material are considered. The analysis of the parameters of recorded resulting acoustic emission signal at the normal and extremely gross wear stages, as well as friction temperature and coefficient, is carried out. Temporal parameters of transition of the friction unit to the extremely gross wear stage are defined by the analyzed parameters. The analysis of change dependencies of percent increase in the analyzed parameters and their sensitivity to friction and wear of the frictional contact surfaces of the composite material is performed. It is determined that, at the stage of normal wear, percent increase in the friction coefficient does not occur, and the percent increase in temperature grows linearly. It is found that the acoustic emission is more sensitive to friction and wear of the surfaces of the composite material relative to the temperature in the friction zone and friction coefficient. It is shown that acoustic emission allows to fix the stage that precedes the extremely gross wear stage, which is an important task in the diagnostics of friction units.

Keywords: acoustic emission, parameters, signal, composite, wear, friction, analysis, increase, surface.

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METHODS OF THE ACTIVE RADIOINTERFERENCE PROTECTION OF THE METEORIC ADIOLOCATION SYSTEM (p. 42-46)

Ivan Antipov, Ruslan Shandrenko, Alexandr Shkarlet

Two methods of active protection of the meteor automated radiolocation system with interference, caused by backscatter sounding (BSS) of the atmosphere were developed in the paper. Such interference occurs when the signal, reflected from the meteor trail (useful signal) and the signal, reflected from the ionosphere (BSS interference) come simultaneously to the meteor radiolocation system receiver input. This interference does not allow to conduct studies of meteors since the useful signal can be absolutely invisible on their background, and most of the important information is lost. During studies, two methods for active BSS interference protection were proposed. The main purpose of these methods is to distinguish the useful signal from interference, provided that the useful signal arrival time is known. The first method suggests using several frequencies for signal transmission and reception. The second method is based on applying noise-like signals (NLS) with several different code sequences.

As a result of the investigation, using simulation, it was found that the most appropriate signal is NPS, based on the Walsh signal, taken from the Hadamard matrix. These studies are of value when using in meteor radiolocation systems as their information about meteor studies will not be distorted. Proposed methods can also be used in meteor communication systems that will allow to improve the communication quality.

Keywords: meteor, meteor radiolocation, ionosphere, interference, correlation, sequence, noise-like signal.

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INNOVATIVE TECHNOLOGIES IN THE LABORATORY TRAINING ON THE COURSE “INFORMATION-MEASURING COMPLEXES” (p. 47-50)

Vladislav Tsidelko, Mykola Chekhovoi, Olga Kyselova, Anna Matviichuk

The paper considers the principles of construction and operation of the laboratory training on an example of the course “Information-measuring complexes” that cannot be imagined without providing students with the appropriate equipment. In present conditions, these aspects require developing and applying innovative approaches based on creating virtual laboratories.

The tasks of the proposed laboratory training include works on measuring the most common physical quantities: temperature, load, vibration, deformation. In these works, studying sensors with intelligent function TEDS was implemented. The operation principle of the complex lies in the possibility of automated control over the experiment using both real measuring equipment, and only software and computer, as well as based on joint use of hardware and software that provide remote access to the measuring stand.

The main difference in the proposed approach to laboratory trainings, which provide a direct implementation of experiments on real models of devices from fully virtual trainings is that the hardware can be used not only for educational purposes, but also in performing scientific experiments and solving the problems of the industrial sector. The possibility to connect real sensors or measuring channel outputs instead of signal simulators to a breadboard, as well as software flexibility provides a wide application range of experimental stand in conducting the research works.

Keywords: experiment automation, virtual instrument, measuring equipment, remote control, laboratory training.

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INFORMATION-MEASURING SYSTEM OF CONTROL OF THE NORMALIZED PARAMETERS OF INDUSTRIAL FACTORSи (p. 51-56)

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The research results of creating the information-measuring control system of normalized parameters of production factors are given in the paper.

Multichannel information-measuring control system of normalized parameters of the production sphere, which allows to automate the information gathering, conversion, processing and display, is developed.

Selection of the sensors of vibration (piezosensors), noise, temperature, air velocity, relative humidity, infrared radiation intensity and atmospheric pressure is made. A computer simulation of sensors and their measuring circuits, in order to study processes, optimize parameters and improve characteristics is performed. A vibration-survey piezoelectric converter to measure the vibration acceleration and vibration velocity is selected. A model of piezoelectric converter with an amplifier and integrator is obtained and investigated.

The results of the control of production factors: vibration, noise, microclimate in the working area are given. Laboratory evaluation of efficiency of the developed control system of the normalized parameters of the production sphere has shown the possibility of its wide application.

According to the studies, using the developed system provides more efficient control of normalized parameters of production factors due to data processing automation and reduced human impact on the measurement results.

Keywords: information-measuring system, normalized parameters, sensors, computer simulation.

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ALGORITHM OF MINIMIZING THE METODICAL ERROR OF ASSESSING THE SIGNAL FREQUENCY BY THE MAXIMUM SPECTRUM (p. 57-60)

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The problem of selecting the weighting function and scale factor taking into account the features of the discrete signal

spectrum is considered. The dependences of maximum values of methodological errors on the normalized frequency when using the Kaiser-Bessel and Dolph-Chebyshev weighting function are described. The adaptive sample optimization algorithm is given. Validating the obtained theoretical results is performed by numerical simulation, which confirmed that using the Dolph-Chebyshev weighting function provides smaller error due to the smaller width of the main lobe of the spectral density for the same maximum levels of side lobes of the Kaiser-Bessel and Dolph-Chebyshev weighting function when measuring signal frequency, containing about one oscillation period. However, with the rise in frequency, monotonous decrease in the sidelobe level of the spectral density of the Kaiser-Bessel weighting function leads to lower estimation error. As a result, with the growth of the estimated signal frequency, the Kaiser-Bessel weighting function has a significant advantage over the Dolph-Chebyshev weighting function. It is shown that, at increasing the number of samples, divergence monotonously decreases. Calculations of dependences with different sampling periods show that increasing the number of samples reduces the shift of theoretical and practical values with zero error and lowers the measurement error during simulation. The reduction rate of the error value with an increase in the relative signal sample length, obtained during the simulation is less than the reduction rate of the error, obtained from theoretical calculations. This is caused by two reasons: DFT use, and expansion of the main spectral component and the inevitable increase in noise exposure including through the signal quantization.

Keywords: space-time signal, diagnostics, reliability, weighting function, spectrum, complex systems.

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