

Keywords: autonomous underwater vehicle, emergency situation, intelligent monitoring and emergency system, ontological approach.

Inzartsev A.V., Gribova V.V., Kleshchev A.S. INTELLIGENT SYSTEM FOR ELABORATION OF AUV ADEQUATE BEHAVIOR IN EMERGENCY SITUATIONS // Underwater Investigation and Robotics. 2015. № 2 (20). P. 4–11.

Monitoring and emergency system (MES) is one of the main components of autonomous underwater robot's (AUV) control system. MES provides both robot safety under the water, and its tolerance to subsystems' failure. It increases the probability of the autonomous underwater vehicle (AUV) mission completion. The key information for recognizing the faults is the signals produced by the self-diagnosis facilities of vehicle subsystems as well as parameters measured by various AUV sensors. Today, the operation of a vehicle's MES is based upon the hypothesis about the isolation of signals. In case of several quasi-simultaneous signals the robot's reaction is not always adequate.

The ontological approach is used for implementation of the proposed intelligent MES (further – the IMES). This approach allows eliminating abovementioned disadvantages of current MES version. IMES functions as a tactic level agent of robot's control system which configured to carry out diagnostic actions (submissions), if necessary. The special compiler forms IMES with the use of a preset knowledge base and robot configuration description on the basis of cloud-based platform IACPaaS. Knowledge is a semantic network. The architecture of the IMES consists of three basic blocks: the block of AUV fault diagnostics knowledge formation, knowledge translator into a program code, and the AUV monitoring and emergency system itself.

There are plans of IMES implementation for AUV software platform developed by Institute for Marine Technology Problems and its comprehensive testing.

Keywords: DTN, underwater acoustic networks, underwater acoustic communication.

Kebkal K.G., Kebkal V.K., Kebkal A.G. DIGITAL HYDROACOUSTIC NETWORKS FOR COMMUNICATION IN CONDITIONS OF LONG DELAYS AND BREAKS THE CON-

NECTION: AN EXPERIMENTAL RESEARCH // Underwater Investigation and Robotics. 2015. № 2 (20). P. 12–19.

Paper presents the development of and experimentation with protocols for an underwater acoustic network that can experience long connection delays, interruptions, or disconnections between its nodes. The experimental results have been obtained during oceanic trials REPI4, organized by the Centre for Marine Research and Experimentation (CMRE) in July 2014. The developed technology enables data transfer in networks of arbitrary topology, in which the nodes are spatially separated so that data transfer from a source and a destination can not be executed directly (data transfer is then only possible via intermediate nodes). Fixed or non-fixed number of intermediate nodes can operate in between the source and receiver. The transmission routing can be static or dynamic. The implementation is based on DTN2 open-source project is a specialized network protocol tolerant of delays and frequent disconnections between network nodes. To adapt the DTN2 software for its execution on-board of the hardware platform of underwater acoustic modems built upon S2C technology (manufactured by Evologics), there has been developed and implemented (on the convergence level of the DTN2) a new, specialized protocol layer, called DMAC CL. The results demonstrate the possibility of using DTN networks in the digital underwater acoustic communication for rapid transmission of short messages (commands), and safe transmission of large amounts of data in an underwater acoustic environment characterized by frequent interruptions/disconnections between neighboring nodes.

Keywords: autonomous underwater vehicle, control agent, data complexation, search and inspection of underwater objects.

Inzartsev A.V., Matvienko Yu.V., Pavin A.M., Rylov N.I. TECHNOLOGIES OF SEABED MONITORING BASED ON INTELLIGENT PROCESSING OF SEARCH SYSTEMS' DATA ONBOARD THE AUTONOMOUS UNDERWATER VEHICLE // Underwater Investigation and Robotics. 2015. № 2 (20). P. 20–28.

Relocation of surveillance and search systems' data processing functions on board the AUV allows, in many cases, dramatically reduce the time spent the robot to monitor the seabed. The comprehensive approach to the AUV "intellectualization"

is used in IMTP FEB RAS. The approach is to develop both the flexible agent-based architecture of the robot control system and operation algorithms of control agents. The principle of complexation of heterogeneous information from the onboard surveillance and search systems is used at the core of the algorithms. It allows increasing the probability of underwater objects detection. The developed technology has been implemented in the AUV series "Marine Technologist". The article discusses some of the results of new technology application in carrying out real maritime operations.

Keywords: AUV, ROV, UUV, modeling environment, simulator, user interface.

Inzartsev A.V., Pavin A.M., Eliseenko G.D., Rod'kin D.N., Sidorenko A.V., Lebedko O.A., Panin M.A. RECONFIGURABLE CROSS-PLATFORM SIMULATOR FOR AUTONOMOUS UNDERWATER VEHICLE // Underwater Investigation and Robotics. 2015. № 2 (20). P. 28–34.

Development of a reliable autonomous underwater vehicles (AUV) software makes it necessary to build a highly scalable simulation environment system. Such simulator meets a series of requirements, such as: reconfiguration, compatibility with real-time operating systems, presence of the graphic user interface, high-performance and ability to integration of various functional modules.

The search for optimal solutions, based on the experience of many AUVs development, defines the basic properties of the simulation environment. In this paper it is assumed that modeling AUV environment has the following main features:

decentralized distributed architecture is very suitable for the reconfigurable simulation environment;

- a web-based interface was used for operator interaction with the simulation environment and the AUV control system;
- a simple reconfiguration of the system is carried out using the web-socket technique for data exchange between AUV modules and a graphic user interface;
- an asynchronous UDP-datagram mechanism was used for data exchange between the server and the running simulation programs.

The experience showed the high effectiveness of the selected approaches and techniques, especially when solving complex tasks that require large computing resources (simulation faster than a real-time mode and photo/acoustic image

rendering). A comparison of modeling experiments with field tests allows speaking of the high quality of the simulation data.

Keywords: laser strainmeter, low-frequency asdic transmitter, transformation, hydroacoustic oscillations, seismoacoustic oscillations, border «water-bottom».

Chupin V.A., Budrin S.S., Dolgikh G.I., Pivovarov A.A., Samchenko A.N., Shvyrev A.N., Yaroshchuk I.O. SEASONAL DEPENDENCE OF TRANSFORMATION COEFFICIENT OF HYDROACOUSTIC INSEISMOACOUSTIC WAVES ON BORDER «WATER-BOTTOM» // Underwater Investigation and Robotics. 2015. № 2 (20). P. 35–39.

Within this work results of data processing are given, obtained during the cycle of experimental work carried out using the same methodology in different seasons of the year to study the laws of transformation of hydroacoustic in seismoacoustic waves on border «water-bottom» in the shelf zone of the Sea of Japan. In an equipment complex as the radiating system is used the low-frequency hydroacoustic radiator with the central frequency radiation of 33 Hz, and as reception system is used a coastal 52.5-meter laser strainmeter. Researches on studying of the nature amplitude variations of the accepted signal during the work of a radiator on various removal from reception system are executed and the analysis of transformation coefficient change of hydroacoustic energy is carried out to seismoacoustic one. It is established that the size of transformation coefficient of hydroacoustic waves in seismoacoustic waves has seasonal variability.

Keywords: underwater acoustics, function of a response of the channel, processing of pulse signals, coherence, structure of arrivals, time of distribution of impulses.

Polovinka Yu.A. CORRECTION OF ERRORS AND SELECTIVE TRACKING OF IMPULSES IN STREAMING DATA OF ACOUSTIC SOUNDING // Underwater Investigation and Robotics. 2015. № 2 (20). P. 40–46.

Impulse signals are used for communication, navigation and a tomography in underwater acoustics, applied in systems of acoustic nondestructive control of non-uniform environments and remote measurements of turbulence, speed of a wind and temperature in the atmosphere.

Accuracy of acoustic methods depends, both on the hardware accuracy of measurements, and from the applied

algorithms of processing of acoustic signals. In work the option of a pulse method of measurements of function of a response of the acoustic channel including correction of mistakes in the obtained data, and also selective maintenance in time and exact measurement of separate pulse arrivals is offered. The method is realized in relation to a stream of blocks of data of acoustic sounding where each block represents the digitized values of pulse function of a response of the acoustic channel. The algorithm of realization of a method includes control of correctness of data and correction of wrong blocks in a stream, selective allocation, maintenance and exact measurement of times of arrival of concrete impulses. Definition and correction of wrong blocks is carried out on the set level of coefficient of mutual correlation of data in the next blocks. Identification, selective allocation and maintenance in time of impulses, in the measured functions of a response, is carried out by search of local maxima and calculation of Euclidean distance between all local maxima, in the blocks of data following one after another and creation of the concrete trajectories connecting maxima according to a condition of the minimum distance between maxima in the next blocks. Measurement of times of arrival of concrete impulses is carried out by selection of values along the calculated trajectories. Numerical realization of a method is executed in the environment of programming of MATLAB. Testing of method and programs was held on the experimental data of pulse sounding in the Sea of Japan obtained in laboratory of an acoustic tomography POI Far East Branch Russian Academy of Sciences in 2005–2012.

The offered method allows to increase accuracy and to automate process of measurements of arrivals times of pulse acoustic signals and can be realized in the technical systems and devices using the amplitude-time principles of measurements of physical quantities.

Keywords: signal, electroacoustic transducer, spatial filter.

Dolgikh V.N., Ushakov K.A. METHODS OF FORMATION OF THE RESPONSE AND THE RESULTS OF THE PROBABILISTIC CHARACTERISTICS OF THE DETECTED SIGNALS OF THE CORRELATION DETECTORS // Underwater Investigation and Robotics. 2015. № 2 (20). P. 46–53.

In order to assess the characteristics of the correlation detectors, the hydro acoustic signals use methods of spatial-temporal and spectral energy processing for the input. This way we achieve the highest possible signal-noise ratio at the input of the prevailing signal-noise conditions. The solution is based on the used methods of formation of spatial correlation filters. The Input signals are random Gaussian processes with zero mean. The task is to research comparative evaluation of the effectiveness of the correlation detectors using estimates of the probability to detect signals with a given probability of false alarms. The methods proposed in the research can reduce the amount of non-linear operations in the formation of the responses, without losing the direction of the spatial properties of the filter.

Keywords: gasgeochemical fields, Okhotsk Sea, Japan Sea, geological structure, tectonics, methane, natural gases, isotopes, gashydrates.

Shakirov R.B. GASGEOCHEMICAL FIELDS OF THE OKHOTSK AND JAPAN SEAS REGIONS // Underwater Investigation and Robotics. 2015. № 2 (20). P. 53–65.

The purpose of the article is a research of the gasgeochemical fields (methane, its homologues, helium, hydrogen, nitrogen, carbon dioxide and others) in the Okhotsk and Japan seas and adjoining coastal areas based on the data for 1980–2014. During research the next step for the clarifying lithospheres sources of the hydrocarbon-gas-fluid systems of these areas. The paper consist of 5 sections: introduction (1), which describes the actuality of scientific problem; description of data and methods (2); presentation of gasgeochemical fields study in the Okhotsk (3) and Japan (4) seas and Summary (5). It is revealed, that the special role in the distribution and intensity of the gasgeochemical fields has a hydrocarbon accumulations and tectonic structures: faults, geotectonics lineaments, rift structures, folding dislocations and others. The gasgeochemical fields of the Okhotsk-Japan Seas area genetically and spatially related to the magmatic rocks, hydrocarbon potential of the sediment basins and basement structure. Noted, that abnormal gasgeochemical fields and gashydrate accumulations formation determined, first of all, by geological structure. The revealed regularities allow enforcing the hydrocarbon deposits searching efficiency in the marginal seas.