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Abstracts

The long-term monitoring of the snapping shrimps acoustical activity in the black sea shallow water

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We carried out close to round-the-clock monitoring of the acoustic activity of snapping shrimps in a fixed point on the Black Sea shelf with coordinates: latitude: 43° 0.4182′ N, longitude: 40o59.358′ E. Registration was carried out in continuous mode with insignificant interruptions. The recorded signal was analysed as a point time process. The existence of daily and seasons variability and fractal features of the process were substantiated. The existence of individual pulses of large amplitude allowed us to set the task of localization of individual clicks.

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Environmental impact on the modeling of the ships hydrodynamic field in shallow water

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The hydrodynamic pressure field (HPF) produced by the flowing ship at the bottom of the shallow sea depends on the shape of the ship's hull, its motion parameters, sea depth, loading method affecting the trim – longitudinal tilt as well as from a wide range of physical and kinematic parameters of the surrounding marine environment – sea current, wind, wind wave, etc. The amplitude and periodic wave characteristics depend in turn on the wind speed, the length of the sea basin and winding time.

The impact of the marine environment may influence the parameters of the ship's motion, such as trimming and rolling the ship, and the sea current may cause an inclined inflow of water to the hull, as well as the yawing of the ship. Achieving too high velocities in shallow water also causes its subsidence – an increase in draft, which in extreme situations leads to contact of the ships bottom with the sea bottom.

The article analyses some of these environmental impacts, which have the greatest impact on the change of HPF according to the obtained research data or the results of numerical calculations.

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The impact of ship's equipment configuration on hydroacoustic frequency response

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A ship moving on the water surface generates disturbances perceived as a noise in the air and underwater space. The underwater space, due to the density of water, is an excellent medium for transmitting acoustic waves over long distances. The recorded disturbances character of the elastic waves depends on the source level, signal frequency and occurrence frequency. Incidental disturbances are difficult to record, therefore the monitoring of underwater noise focuses on long-term sources assigned to the analysed object features.

The article describes the impact of ship machinery settings on the generated noise nature. The data was obtained using an underwater measurement system. The measured object was a ship moving on specific trajectories with given device parameters. The results were calculated to a specified distance from the ship. The comparison was presented in the form of frequency spectra and an RMS value for CPA (Closest Point of Approach).

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Detection of floating objects based on hydroacoustic and hydrodynamic pressure measurements in coastal zone

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The development of coastal infrastructure and related maritime transport forces the intensification of vessel traffic monitoring. Navigation systems used in this research are based on the information transmitted by radio waves.

The paper presents a comparison of different distance measures for classification of the UAC channel as being WSS/non-WSS and US/non-US. The results were obtained in simulations performed using impulse responses gathered during the experiment conducted in an inland reservoir.

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Efficiency of cooling system designed for transplant surgery by numerical model and Doppler measurements

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The transplant surgery is the gold standard for treatment the high-risk organ failure such as heart or kidneys. In recent years, there has been a significant development of transplantation techniques and devices supporting and maintaining the organs during transplantation process. The success of the transplantation procedure and the proper protection of the organ depends among other on the proper cooling of the graft. A novel cooling system was designed to maintain an even temperature distribution of the organ during surgery process. It is assumed that a suitable temperature distribution is associated with the laminar flow of the circulated fluid. The properties of the liquid flow in a geometrically complicated canal system, particularly the lack of "dead" flow fields, the sufficient values of velocity and the bounded values of velocity gradients of propagation of the cooling liquid were determined using numerical calculation. The results obtained during the real-time ultrasonic measurements, by using the 20 MHz Doppler are compared to the results obtained by the model of the device implemented in commercial finite elements method. Both, the conducted experimental test and numerical simulation allow correct validation of the cooling device efficiency.

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Underwater noises of open circuit scuba diver

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Passive acoustic monitoring of scuba divers is promising to ensure the safety of diving and to prevent intrusion of terrorists or poachers from waterside. Respiratory noises and noises of fins emitted by a scuba diver into water may be applicable here.

The respiratory noises of open circuit scuba diver consist of the noise of exhaled air bubble detachment from the breathing apparatus and floating bubbles noise in exhalation, while in inspiration noises are connected to the operation of the high-pressure reducer in scuba apparatus. These powerful quasi-periodic signals have a repetition frequency which corresponds to diver's respiratory rate. Noises of fins are associated with hydrodynamic vortices created by their oscillatory movement.

Experimental study in shallow-water regions demonstrated that recording respiratory noises of a scuba diver associated with the noise of floating bubbles in spectrograms provided tracing acoustic signs and evaluation of respiratory rate at distances up to 200 m. The same acoustic signs provided monitoring displacement of the scuba diver by determining time delays of maxima of cross-correlation function at 2 hydrophones. Trails of such delays in correlograms may be traced at distances up to 300 m.

The main sources of scuba diver noises have small wave size and can be theoretically considered as the point multipole emitters. The respiratory noises source is closer to monopole one. While noises of fins movement are predominantly characterized by dipole and quadrupole emitters having powerful near-field components of radial and tangential vibrational velocity. Thus in accordance with higher susceptibility of pressure gradient (vector) sensors to near-field components of the vibrational velocity, the registration of noises of fins in the near field with these transducers should be more promising than with commonly used hydrophones.

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Propagation of underwater acoustic disturbances generated by moving marine objects in the shallow sea – basic problems

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The issue of propagation of acoustic waves in limited media, e.g. shallow sea, is associated with multipath propagation. This is due to multiple reflections from the free surface of the sea and from the bottom. Considering the ecological acoustic aspects related to current trends prevailing in the policy on the protection of the underwater environment (European Union Directive on Good Environmental Status – descriptive indicator 11 – noise), as well as factors related to security problems associated to asymmetrical threats (e.g. terroristic threat where underwater transport is used), these factors gain additional weight.

The paper presents the theoretical issue of the propagation of acoustic waves associated with the source of waves moving underwater. The problem's solution is a series of wave modes, which at a suitable distance from the source are a description of the acoustic field. A significant influence on the propagation range has the boundary condition at the sea – water bottom border, which is connected with the penetration of acoustic energy into the bottom. The final part of the paper is the projection of the prediction acoustic wave coverage for the experimentally measured disturbance, e.g. the noise of the submarine as a source, taking into account selected components of the spectrum. Using the theory of wave propagation in the form of wave modes, transmission losses is determined.

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