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C H R O N I C L E

5th EAA International Symposium on Hydroacoustics

The 5th EAA International Symposium on Hydroacoustics together with domestic XXII Symposium on Hydroacoustics took place in Puck at the Sport and Training Centre DELFIN, May 16–19, 2005.

The 5th EAA International Symposium on Hydroacoustics was organized by Naval Academy in Gdynia, Gdańsk University of Technology, European Acoustic Association, Polish Acoustical Society (Gdańsk Division) and Ultrasonic Division of the Committee on Acoustics of the Polish Academy of Sciences. Prof. Grażyna Grelowska, the vice-rector of Naval Academy in Gdynia, was the chairman of the Organizing Committee.

There were professors from famous European universities in the Scientific Committee. The professors arrived from, among others, Germany, Denmark, Russia, France, Italy, Greece, Turkey and Poland. The chairman of Scientific Committee was Prof. Eugeniusz Kozaczka who is the president of Polish Acoustical Society and who represents Poland in European Acoustics Association.

The main aim of the symposium is giving opportunity to exchanging experiences and information among research centres dealing with underwater acoustics and ultrasound.

The Symposium subject included:

- sound propagation in the sea,
- ambient and ship noise,
- nonlinear acoustics,
- ultrasonic transducers,
- signal and data processing,
- sonar systems,
- other topics related to underwater acoustics.

70 scientists have registered to the Symposium representing research centres mainly from Poland but also from other European countries and Canada.

30 papers were presented, including 3 following invited papers:

- E. Kozaczka – Modern applications of maritime technology.
- A. Bobrowicz – Obrona bierna okrętów Marynarki wojennej RP.
- I. Didenkulov, S. Muyakshin, D. Selivanovsky – Rotation of small particles in sound field and possible mechanism of sound perception.

All accepted papers were published in the periodical “Hydroacoustics” vol. 8.

Abstracts

1. Analysis of the KZK equation solution for fixed pressure distributions at the piston

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The paper presents the results of the numerical investigations of the finite amplitude waves interaction problem for circular piston with Gaussian pressure amplitude. The mathematical model and some results of numerical investigations are presented. The mathematical model was built on the basis on the Khokhlov–Zabolotskaya–Kuznetsov equation (KZK equation). To solve the problem the finite-difference method was applied. The on-axis pressure amplitude as a function of distance from the source for different frequency waves and their pressure amplitude distributions at horizontal section were investigated. The calculations were done for different values of source and medium parameters. The results of computer calculations were compared with analytical solutions of the KZK equation in special cases.

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2. 3D reconstruction of seafloor from side-scan records

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The modern underwater acoustic equipment, like multibeam sonar, is able to provide the data which allows for unambiguous localization and also 3D visualisation of targets of different kinds, including wrecks, mines and other submerged objects. The large amount of information that seems to be useful for this purpose, could also be extracted from side-scan sonar data, which has been collected over years within different survey regions. In this context, the paper concerns the development of side-scan data processing method for 3D reconstruction of seafloor and its imaging. In this paper, two novel approaches are proposed. The first utilises the more accurate models of backscattering, including the differences in signatures of several types of objects. The second is based on definition and investigation of some quantitative descriptors of geometric features expected to be found in images of localised objects of artificial origin. The preliminary results obtained by application of these techniques to side-scan sonar data processing will be discussed in this paper.

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3. Application of CDMA modulated signals in seafloor remote sensing

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The paper investigates the application of digital modulation access technique called Code Division Multiple Access (CDMA) to remote sensing of a seafloor. In a traditional sonar, the next ping cannot be sent until the echo from previous transmission has been received by the sonar transducer. As a result, such a sonar system is characterized by low duty ratio what causes the decrease of data resolution especially for larger depths. Using the CDMA modulation technique, may reduce pulse repetition rate. In the CDMA technique, each sonar pulse consists of several multiple narrow pulses, where each is encoded with a phase shift 0 or π based on a spreading code. The paper presents the performance investigation results for this modulation scheme as applied both to transmitted and seafloor backscattered signal. The bottom

backscattering was modeled numerically for typical bottom material and morphology. The advantages and constraints of the proposed technique were discussed in the context of echo detection and usefulness in acoustic seafloor characterization

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4. Rotation motion of small particles in sound field and possible mechanism of sound perception

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It is known several mechanisms of perception of sound by hydrobionts. However for simple organisms like small crayfish it is not clear how they can detect sound. One of possibilities is to detect oscillation water motion by microhairs. In this paper it is analyzed a physical mechanism of rotation oscillations of small particles in acoustic field and it application to a problem of sound perception by some hydrobionts.

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5. Observation of sonoluminescence and subharmonics

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In this paper we describe results of experimental investigation of multibubble sonoluminescence. Experiments were done in an acoustic resonator with water. It was found that sonoluminescence and subharmonics occurrence follows by each other when the amplitude of acoustic pump wave in the resonator increases and decreases. It was also observed a hysteresis effect.

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6. High resolution multi-beam side looking sonar

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The conventional side–scan sonars does not ensure sufficient angular and range resolution to detect very small objects with small target strength. Decrease of beam width leads to the increase of angular resolution but requires the decrease of towing speed what means reduction of searched area. Other method of the angular resolution increased is designing multi–beam sonar or sonar with synthetic aperture. The paper presents a design of effective multi–beam side looking sonars with a large angular and range resolution operates with 100 kHz, 200 kHz, 400 kHz and 600 kHz. The sonar, described in the paper, operates with 200 kHz frequency; LFM modulation — 20 kHz and 40 kHz band; array provides 32 elements with d/λ spacing what ensure a shaping of 5 or 9 beams with 0,40° width. The range of sonar is from 250 m to 300 m, the level of side lobes are smaller than -20 dB and level of grating lobes for 5 beams are smaller than -30 dB. The principle of sonar performance and wideband effective processing are presented. Effectiveness of processing depends on beams number and decrease of beams number, together with the range increased, leads to increase of processing effectiveness.

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7. Acoustic sensing of hydrodynamic vortex flow

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We report the results of experiments of sound scattering by a vortex flow formed behind a grid of vertical cylinders placed in an air flow. The experiments were carried out in a low turbulence wind tunnel at a low Reynolds number. The vortex flow was formed behind a grid of 3–10 of hollow cylinders with the $d = 2$ mm and length 30 mm. During the experiments we could change the gap between the cylinders $g = L/d$ (where L is a distance between the cylinders surfaces) from 3 to 5. The experiments showed that at a certain value of g vortex flows behind different cylinders could synchronize and this effect could be easily detected by means of distant acoustic sensing. This result was also confirmed by means of direct measurements of velocity field of the vortex flow.

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8. Can we precisely estimate fish sizes using acoustics?

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Fish target strength (TS) is the key quantity in the acoustic assessment of fish abundance and biomass. Since TS is the function not only of fish length, but also depends on species, physiological state, behavior, and environmental parameters, calculation of fish real length on the basis of acoustical data is not a trivial task. Commonly fish size distribution is estimated from TS distribution using Love's formula. In the present paper fish target strengths for typical European freshwater species were determined experimentally and based on these results a mathematical model has been constructed. The model accounts for the TS/L relationship for a given species and for fish behavior. From the single fish measurements in cages three types of fish behavior were distinguished and incorporated into the model. Fish size distributions resulting from the model were compared with those obtained using directly Love's formula and from the net catches.

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9. Acoustic communications in shallow waters

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The shallow water channel is an environment which is of particular interest to many research workers. An underwater acoustic channel is characterized as a multipath channel. Severe signal degradation can occur in such a channel due to multipath effects and the refractive properties of the channel, which may include multiple interactions with the sea bottom and sea surface. Time-varying multipath propagation is

one of the major factors that limit acoustic communication performance in shallow water. In this paper the results of an analysis of broadband shallow water acoustic signal was shown. Linear FM pulses were chosen as the main transmit signal for numerical experiments. The transmitted signal goes through multiple paths in order to reach the receiver. The numerical simulations were performed using the broadband normal mode model. This software channel simulator is capable of simulating the effect of the shallow water propagation channel on an input broadband acoustic signal and can be used for simulations of sound propagation through both a time- and range-varing propagation channel. The received signals were all matched filtered revealing the multipath arrival structure.

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10. Dynamic control of the receiving beam horizontal cross-section in the side scan sonar

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A decade old side scan sonars are now being modernised by way of dynamically controlling the width of the receiving beam in the horizontal cross-section. The result is a quasi-constant linear resolution of the sonar (replacing constant angular resolution), when it picks up echo signals as it moves further away from the targets. The advantage of the treatment is that the ship using the side scan sonar can increase its speed without risking the loss of near targets' echo. The articles describes how the system of dynamic control was implemented. Special TVG systems were introduced to control dynamic signal gain from several separate sections of the sonar's acoustic array, which was divided symmetrically into unequal sections. The location of these systems in the sonar's receiver is presented. Examples are given of curves that control TVG and of the effects of dynamic horizontal stabilisation of the sonar's linear resolution as it receives signals.

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11. OFDM modulation and adaptive equalization for underwater communications

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Transmission performances of a shallow underwater channel are limited due to multiple reflections of sound waves off the bottom and water surface, and to the non-stationarity caused mainly by water surface movement. In traditional narrowband telecommunication modems complex Decision Feedback Equalizers are used for minimizing the influence of intersymbol interferences caused by multipath propagation of sound waves. The article proposes adapting OFDM modulation and adaptive equalization based on Kalman filtration techniques for use in underwater communications system. The OFDM modulation is used in wideband ADSL telecommunication modems. The Kalman filtration algorithm is used for time-varying processes identification. The techniques were tested in simulation environment with promising results.

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12. Modern applications of maritime technology

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In recent times, we have been observing a significant development of acoustic methods in underwater research. At the same time, we have easier and cheaper means of access for acoustic sensors to survey with a greater detail and more precise positioning of underwater objects. Recently, detailed investigation of underwater military, but not only the applications, has involved state-of-the-art technologies. Detection and examination of the shallow as well as deep underwater areas, using advanced technologies, have opened a new era in the ocean science. The human-operated vehicles, remotely operated vehicles and autonomous underwater vehicles have been employed for this purpose with great success. A new method of underwater observations, namely the acoustic time reversal method, has been applied in ocean investigations.

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13. Nonlinear ultrasound propagation in water from square focused transducer

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The nonlinear pulsed acoustic pressure field from a focused square aperture is considered. Experimental measurements in water of a 4D sound field radiated from a 2.8 MHz focused square transducer of a 20 mm side and a 80 mm focal distance for excitation level producing an average acoustic pressure $P0 = 0.14$ MPa at its surface are presented. The obtained results are compared with the numerical calculation results for the same boundary conditions. The novel, free from paraxial approximation and computationally efficient numerical algorithm was used to simulate the 4D nonlinear pulsed pressure field from the nonaxisymmetric acoustic source. Our theoretical model was based on the Time-Averaged Pressure Envelope (TAPE) method recently developed that enable to represent the propagated pulsed disturbance as a superposition of sinusoidal wavelets with carrier frequencies being the harmonics of the initial tone burst and with envelopes determined by the TAPE method. The novel approach to the solution of the nonlinear wave equation enabled to simulate full 4D nonlinear field for given boundary conditions in a dozen or so minutes utilizing the computational power of the standard PC.

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14. Determining the impedance of ultrasonic transducers by the added elements method

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There are a number of problems involved in measuring complex electrical impedance of ultrasonic transducers. This is because in the frequency function impedance tends to change values rapidly, in particular where resonances are involved. Measuring impedance using accurate bridge methods is a tedious

and time-consuming process. While modern automated systems offer shorter test periods and high accuracy, they are very costly. This is why the project aims to implement new methods for computing impedance without these limitations. The article proposes a new, simplified method for measuring the electrical impedance of ultrasonic transducers. In the method complex impedance is calculated from results of two measurements of the transducer's impedance magnitude only: with the known reactance and without it. To demonstrate the practicality of this method the authors included in the article the value of complex electrical impedance computed using the method and compared these with the results of measurements taken with an automated typical measurement system.

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15. Maritime awareness and emergency management real time system using remotely accessible GIS technology

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The paper concerns the concept of the application of the latest achievements in both information technology and remote sensing, including underwater acoustic sensors, for maritime awareness and emergency management supporting in a case of hazard of a different kind, e.g. terrorism, pollution and ecological catastrophes, or natural disasters. The real-time, remotely accessible marine GIS is dedicated for instantaneous integration, processing and multi aspect visualisation, in a form of time variable views and maps, of the data acquired by various types of sensors. The paper presents the prototype application of the marine GIS for remotely accessible, instantaneous detection, localisation and monitoring of sea water pollution aggregations, e.g. oil spills, discharge material plumes etc. The developed system is also capable of performing the instantaneous prediction of the pollutants' behaviour, i.e. the dislocation and spreading of an oil spill, in the nearest future, using the relevant physical models. The system utilises the SQL database for data storage and the SVG language for geographical objects remote presentation, and requires only the WWW browser and SVG viewer on the client side.

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16. Possibilities of detection and identification objects located on the sea bottom by means of a simple sidescan sonar

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Several underwater tasks require detail visualisation of a water space and bottom features. Search and identification of sea mines or explosives are good examples of such activity. To achieve high capability of detection and correct identification, high accuracy and resolution are required. One of the valuable tools, that can be used for acoustic visualisation are side scan sonars. They are in use since early beginning of underwater activity, but it is only recently that applications of high frequency, high definition sonars are being investigated. First research results show a need regarding better understanding of equipment specification. The aim of a research, reflected in this paper, is to study possibilities of detection and identification of objects located on the sea bottom or slightly buried by means of a side-scaning sonar. The sonar considered is installed on Remotely Operated cable controlled Vehicle (ROV) or Autonomous Underwater Vehicle (AUV) that introduces important limitations to size, weight and power consumption of sonar system. Theoretical evaluation of sonar parameters and definition of information needed for detection and recognition

of selected types of object are required for this purpose. For experimental evaluation of theoretical consideration typical industrial equipment has been selected. Tritech International Sea King Side Scan Sonar provides basic facilities. It is modified to allow direct comparison of two images obtained simultaneously from two transducers working at different frequencies.

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17. Complex signals based on short chirp signals and phase coding

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The main problem associated with detecting and locating of objects by means of radiolocation and hydrolocation systems is the appropriate selection of transmitting signals. These signals need to be difficult to detect by the watched object and need to be resistant to disturbances. The most often used ones are signals with linear frequency modulation (chirp signals) and signals with phase coding. New possibilities of the realization of complex signals appeared along with development of the digital technique. The usage of signal composite from short signals with linear frequency modulation with use of phase coding was analysed in this paper. Short noise-like sequences (Barker's codes) were used for coding the initial phase of chirp signals. This article presents results of research obtained for a signal of this type, at its identification by means of matching filtration. These results were compared with results obtained for single signal with linear frequency modulation with the same duration and bandwidth.

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18. Monochromatic acoustic recognition of scattering layers: case studies in the Turkish seas

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One of the major problems in bioacoustics, direct identification of organisms at species level was reviewed with comparison between modern acoustic-based statistics (algorithms, multivariate analyses, scattering models) and observatory acoustics on behavioral natures ascertained to the species (diel vertical migration, response to ambiance, school shapes). Modern biacoustics promise surely gate soon to fulfill solution of the problems. Presently, current acoustical knowledge required behavioral characterization identical to organisms targeted for direct identification. Integrating such techniques with previously obtained background knowledge on characteristics specific to certain organisms, acoustic techniques allow a significantly larger area of the ocean interior to be surveyed at a quite finer resolution on ecology of the scatterers than conventional methods. For instance, *Calanus euxinus (copepod)* and *Sagitta setosa (cheatognath)* have distinct patterns of vertical migration and time spent swimming, depending on the DO concentration of the water column in the Black Sea.

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19. Acoustic reconnaissance of fish and environmental background in demersal zone in southern Baltic. Part 2. Seabed

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The paper describes results of studies based on measurements of the Sv distribution in 3 m layer over the bottom in the southern Baltic area for the period 1995–2004. These are correlated with values of coin-

cident bottom features, estimated on the basis of all available survey data. It is considered that values of Sv are proportional to demersal fish (herring, cod, flatfish) density. Seabed classification was based on analysis of duration of bottom echo recordings collected during the same series of surveys. Normalized (against the depth) bottom echo duration – $\Theta'/2$ was applied as 1D parameter characterizing seabed properties. Geographical distribution of this parameter and its dependence on other determined factors were analyzed. Studies of irregularities in fish distribution and its correlation to $\Theta'/2$ values were made. The paper gives a new method of acoustic classification of seabed and shows also some conclusions on coincidence of bottom features and environmental background.

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20. Seabed volume scatter dependence on difficult-to-measure parameters

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Backscatter from the seabed can, for certain sediment types, frequencies and angles, be dominated by volume scatter from within the seabed. In the frequencies above about 100 kHz, the penetration is small and gross layering within the seabed is not of concern. However, the scatter from the volume at these shallow depths is determined by the inhomogeneities in the sediment properties, in particular their correlation structure. The sensitivity of the backscatter to the spatial correlation structure of the scatterers is highlighted in this paper.

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21. Analysis of noisy signals on base of differential correlation algorithms

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Correlation analysis (CA) in PCM format is often used in signal recognition. Signals representation in PCM format allows for calculate correlation functions (CF) with assign accuracy, however at the same time causes a large number of multi-bit operations and leads to insufficient resolution and fast-acting of CA. Therefore, in such tasks it is expedient to use small-bit differential methods. However, the known approaches to differential CA are not enough studied. This paper purpose is the resolution and fast-acting increase of noisy signals CA in real time on base of modified differential PCM (DPCM) algorithms.

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22. Processing the complex signal in the acoustic processor of a sonobuoy system

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The article presents digital methods for processing the complex signal in the acoustic processor of a sonobuoy. The overall system design and the complex signal are presented. Two alternative methods for

signal processing are discussed: in the time domain and in the frequency domain. Block diagrams of the algorithms of both processing methods are included. The problems involved in the practical implementation of data analysis methods are discussed. The problems are produced by the phenomena occurring in the system's analogue section and by the complexity of the computation related to how powerful the digital algorithms are. The computation errors in both methods are analysed. The advantages and disadvantages of the different signal processing methods are discussed, with emphasis on the practicality of the device. The advantage of the processing method in the frequency domain is explained. Graphic images of the results of both processing methods are included on the example of real signals received during the study.

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23. Application of the perfect combinatorial configurations for configure of high performance sonar systems

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Perfect combinatorial configurations can be used for finding optimal placement of structural elements in spatially distributed sonar or acoustic systems for configure high performance systems with non-uniform structure (e.g. arays of sonar antennas) with respect to positioning precision, and resolving ability, using novel design based on combinatorial configurations such as "Golomb rulers" and difference sets. These design techniques make it possible to configure sonar systems with fewer elements than at present, while maintaining or improving on resolving ability and the other significant operating characteristics of the system.

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24. Underwater communication system for shallow water using modified MFSK modulation

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The paper describes the design and operation of the Modified MFSK system for underwater communication. Its function is to transmit data and commands from ships to underwater objects in shallow coastal waters and lakes. The system was primarily required to ensure energy efficiency in its underwater section and the minimum of transmission errors. The emphasis was on nonlinear distortions produced in piezoelectric transducers, an untypical source of errors.

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25. The observation of reverberation in the ocean by acoustic combined receiver

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Results of observation of low-frequency tone pulse reverberation in deep open ocean by means of the combined sensor are presented. As the experiment showed, net energy flux density vector of the echo-signal carries information on properties of scattering directionality. The paper shows that the energy flux density

vector of the field of surface–scattered low-frequency sound has both random and regular contributions. The regular contribution can be identified as the diffraction spectrum of scattered sound that is in line with the theory developed by L. Brekhovskikh. Lifetime of regular orderly structures existing in surface roughness is no less than 96 s as the experiment proves. The surface roughness diffraction lattice is likely to be built of swell waves.

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26. Application of PCA as an acoustical signal processing tool for object classification purposes

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The authors presented a technique for an optimal representation of acoustical signals for further object classification purposes using different statistical and neural methods. It is based on principal component analysis (PCA) which is a transformation of vectors localized in k-dimensional observation (feature) space into lower n-dimensional component space retaining majority of included information. The resulting improvement in classification efficiency by a chosen statistical classifier was verified by a numerical experiment.

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27. Synthesis of sonar images in the process of comparative navigation

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The main source of image information in the system of comparative position plotting is the image of navigational sonar compared with a sonar chart generated on the basis of a bottom shape model. The paper presents a method of generating simulated sonar images indispensable in the process of comparative navigation.

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28. Spatial variation in the occurrence and density of pelagic fish in lake Łańsk: monitoring with hydroacoustic and catch methods

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The study was conducted in Lake Łańsk (surface area – 1042 ha, maximum depth – 53 m), in which the former dominant was vendace. Commercial catch results from the past decade indicate that there has been a seventy-two-fold decreased in vendace stocks. Hydroacoustic estimates indicate that there are 7.9 million fish in the pelagic zone. Approximately 93% of these inhabit the epilimnion (6.8 thousand fish·ha^{-1}), which is 7.6 times larger than that in the hypolimnion. There were 2.5 times fewer fish in a similarly sized southern region of the lake in 2004 than in 2001. Using the numbers, species structure, and individual weight, the biomass of the fish inhabiting the pelagic zone was calculated at 194.7 kg·ha^{-1}. The largest share was of vendace at 45.7% (89.0 kg·ha^{-1}), followed by roach at 18% (35.0 kg·ha^{-1}) and bleak at 13.1% (25.5 kg·ha^{-1}). The share of 0+ age group vendace was determined to be 70%. This might explain

the decrease in commercial vendace catches caused by poor environmental conditions and overfishing. It also forecasts an improvement in resources of this species in the coming years.

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29. The utility of synthetic aperture sonar in seafloor imaging

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Synthetic Aperture Sonar (SAS) is a high-resolution acoustic imaging technique which is an extension of normal sidescan sonar imaging. The cross-range (azimuthal) resolution in real aperture sonar is dependent on distance to the illuminated scene and signal frequency. Moreover, required azimuth resolution usually needs a beamwidth narrower (enlarged real aperture) than what can be achieved in practice by sized physical antenna. Synthetic aperture sonar overcomes all these constraints, which are discussed in this paper. The specific mode of SAS explained and analyzed here is known as stripmapping. In this mode, platform which contains a transmitter and a receiver, emits consecutively pulses to the examined area in range direction, which is perpendicular to the direction of travel. An appropriate coherent combination of received echos leads to formation of synthetically enlarged aperture. Synthetic aperture processing allows to obtain a high-resolution image of the examined seafloor. This paper covers basic SAS processing algorithm and shows some results of numerical simulation.

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30. Influence of the adcp geometry on the results of measurement

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The problem of verification of the fundamental rule of operation of Acoustic Doppler Current Profiler assuming the uniform current field within the four acoustic beams is studied. Analysis of scattering differences observed in four beams allows us to conclude about the homogeneity or inhomogeneity of the flow field. Geometry of the measurement performed by the ADCP is presented. The distance between beams, sampling volume and vertical resolution are studied in connection with the system parameters and depth of beam penetration. The so called anomaly index is invented in order to find the areas of the strongest variability. Examples of the inhomogeneity of the acoustic field within the measuring setup are presented and analysed. Differences observed in the strength of echosignal obtained by ADCP (150 kHz) and ELAC echosounder (30 kHz) are also analysed. Some reasonable explanations are examined, like the resonance of gas bubbles included inside the bodies and directional response of animals.

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31. Statistical energy analysis methods in marine applications

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In this paper, general overview of Statistical Energy Analysis (SEA) method is presented, especially, SEA method in marine application is described – noise prediction on board and noise emission into the environment (air and water). There are two examples of the use of SEA.

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32. Transparent PLZT ceramics and their practical use

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Piezoelectric ceramics lead zirconate titanate (PZT) is a material of high technological importance due to its applications in solid-state actuators, transducers and sensors. La^{+3} ion can be substituted for Pb^{+2} ion in PZT system (as called PLZT) because of its similar ionic sizes. This paper summarizes properties of transparent PLZT ceramics and their practical use.

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33. Precision acoustic navigation for remotely operated vehicles (ROV)

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The ability to navigate a ROV to exact bottom locations or along a precise path is essential to many scientific and engineering tasks. Bottom and water column surveys along a precise and repeatable trajectory allow the monitoring of chemical and physical variables, and the study of sedimentation processes and biological phenomena. Precise navigation is also required for high-resolution synthetic sonar observations and for placement and retrieval of various devices on the bottom. This paper reviews principles behind acoustic navigation and provides a survey of commercially available Ultra-Short Baseline (USBL) navigation systems. A novel high precision navigation system is proposed that offers several advantages over the surveyed systems. Specifically, the precise position and trajectory of a ROV tethered by a cable to a bottom node is obtained using sensitive phase measurement of an acoustic signal. Proof of this concept through shallow-water and deep-water prototypes will be carried out shortly at the University of Victoria.

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34. Method of creating patterns for hydroacoustics signals

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The paper presents method used to creating patterns for hydroacoustics signals for necessity of sound identification or classification. First the mathematical fundamentals, with breaking to separate processed blocks, of proposed method were introduced. Next the description of realized research and discussion about some obtained results were presented. At the end of the paper the direction of development in creating patterns for hydroacoustics signals and its selectors were pointed.

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