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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 forces driving streaming in presence of scatterers mimicking the blood cells or the contrast agents

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In lossy homogenous fluid streaming velocity is generated by Acoustical Driving Force (ADF) which depends only on absorption and intensity of ultrasound. In suspension of solid or fluid inclusions and in some cases, such as ultrasound scattered on blood cells at high frequencies, or the presence of ultrasound contrast agents, scattering generate additional components to ADF and affects the streaming speed. Using the scattering theory, the single particle (inclusion) ADF was calculated as the integral of the momentum density tensor components over the heterogeneity volume. The possibility of negative ADF was indicated. Then, the total ADF acting on inclusions only was determined as a function of its concentration. The formula for the relative increase in ADF, resulting from increased concentration was derived. Numerical ADF calculations are presented.

In experiments the streaming velocities in a blood-mimicking starch suspension in water and Bracco BR14 contrast agent (SF6 gas capsules) were measured. The source of the streaming was a plane 2 mm diameter 20 MHz ultrasonic transducer. Velocity was estimated from the averaged Doppler spectrum. For different starch concentrations, the streaming velocity increased from 7.9 mm/s measured in reference homogenous liquid to 12.5 mm/s. This corresponds to a constant 14% velocity increase for a $4 \times 20\,000$ l/mm^3 concentration rise. For BR14, its streaming velocity remained constant at 7.2 mm/s, is relatively negative in relation to the speed of the reference liquid and was independent of the concentration. This indicates that it is the speed of the inclusions, not the surrounding fluid. It results from the balance of Stokes drag force and negative ADF. Numerical calculations showed a 16% increase in streaming velocity for 20 000 particles/mm^3 starch concentration rise, very similar to the experimental results. The theory has also shown the ability to reduce the streaming velocity by low-density scatterers, as was experimentally proved using the BR14 contrast agent.

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A toolbox for simulations of acoustic propagation in tissue mimicking structures

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Optimization of ultrasound applications in medical diagnostics as well as in nondestructive testing requires accurate simulations of acoustic waves propagation in nonhomogeneous media. Several attempts were made and few different simulations methods were proposed as a publicly available software toolboxes.

A new, freely available third party toolbox for the simulation of acoustic wave fields is presented and described. The toolbox *USim* is designed to make an acoustic modeling of ultrasound propagation in tissues reliable and fast, with interface similar to the *field II* software. The forward simulations of the wave fields are based on the Born-Neumann single scattering approximation of the solution of Sturm-Liouville equation.

The toolbox allows simulating the ultrasound wave propagation in nonhomogeneous media containing geometrical scatterers similar to those existing in a real tissues. The approach of calculations conducted in Fourier space increases the efficiency of the calculations and allows taking into account the absorption and density of the medium. The construction of an efficient simulator in the time-space domain would be impossible due to the large relative size of the phantom models.

The presented *USim* simulation software uses Single Instruction Multiple Data architectures of heterogeneous computers to make efficient computations through massively parallel computing.

The validation of the simulations' results is done by the comparison with the results of the other ultrasound simulation software.

Student Presentations

The practice of gynecologists-obstetricians working in different reference level centers regarding the examination of the mammary gland

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Background. In recent years breast cancer has become more frequent among young women, who initially inform their gynecologist about first signs of the disease. It is therefore natural that we increasingly wonder whether this subject is included in the spectrum of interests of obstetrics and gynecology specialists (OB&GYN). In addition, it is important for the early detection of breast lesions in young patients to be possible thanks to physical examination and ultrasonography.

Objective. To check the OB&GYN awareness of breast diseases and their diagnostics through examination and ultrasonography.

Materials and methods. Anonymous questionnaires conducted on a group of 55 physicians in centers with different level of reference in the Pomorskie voivodship and Warminsko-Mazurskie voivodship as a control group. The questionnaire contained 13 multiple-choice, single-answer questions. The subject mainly concerned cancer diseases history taking, physical examination and mammary gland ultrasonography usage and professional experience.

Results. 95% of respondents do not routinely examine mammary glands of a patient during a gynecological