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Chronicle

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The Scientific and Organizing Committees of 59th Open Seminar on Acoustics would like to present the abstracts of papers submitted for this conference. The Open Seminar on Acoustics (OSA) is an annual conference, the largest in the country which has been bringing Polish acousticians together for nearly sixty years. It is organized sequentially by different departments of Polish Acoustical Society (PTA) – in 2012 by the Poznań Division. The conference presents all sections of acoustics, such as: physical acoustics, technical acoustics, environmental acoustics, speech acoustics, hearing acoustics, musical acoustics, architectural acoustics, etc. The aim of the conference is to exchange scientific experience in the field of acoustics, promote science and integrate specialists from various fields. The integration of Polish acousticians is extremely important because of the interdisciplinary nature of acoustics as a science. This allows the exchange of ideas, research methods and possibilities of application used by researchers and practitioners the many branches of acoustics.

Arkadiusz Józefczak
Organizing Committee Chairman

Abstracts

Computer simulations for testing the acoustic field using intensive sound method

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The paper is an attempt of presentation of multivariant analyses of acoustic field on the basis of tests made with use of intensive sound method. The scope of tests refers especially to the impact of existing objects on acoustic field in open spaces (environment). Computer simulations in the scope of tests of acoustic field with use of intensive sound method were the subject of the analyses. The simulations were possible after a series of acoustic measurements made at the previous stage of the project. The measurements were made in a closed space and in the environment surrounding the tested object. The scope of applied tests covered the measurements of sound intensity with use of intensive sound method inside industrial object as well as the measurements of sound level in the environment taken by the pressure method at points, which were under assessment. A series of computer simulations, which aimed at validation of intensive sound method, as well as at proving the superiority of this method in testing of acoustic field in the environment were the project objectives. Scope of the project includes the tests carried out in anechoic chamber at the Institute of Thermal Technology in Lodz as well as the tests realized on industrial object.

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Statistical analysis of the equivalent noise level

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In the article, the authors focus their attention on the analysis of the probability density function of the equiva-

lent noise level in the context of the problems of the analysis of the uncertainty results present in the control of environmental noise hazards. They examine the issues of accuracy and applicability of the classical normal distribution for the interval estimation of the expected values of the equivalent sound level. What is more, they provide procedures for its derivation, with the assumption of a given distribution of the results produced by sample results of measurements. The results obtained give grounds for the correct calculation of the uncertainty of the controlled rate of acoustic environmental hazards.

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A perceptionist's view on psychoacoustics

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Psychoacoustics is traditionally based on a world model that assumes a physical world existing independently of any observer – the so-called objective world. Being exposed to this world, an observer is impinged upon by a variety of stimuli reaching his/her sensory organs. These stimuli, if physiologically adequate, may cause biological transduction and signal processing in the sensory organs and its afferent pathways in such a way that finally a specific excitation of the cortex takes place, which results in sensations to appear in the observer's perceptual world. The sensations are understood as being subjective, since they require an observer to exist. This world model – also known as (objectivistic) realism – reaches its limits when it comes to explaining more complex phenomena of perception. Thereupon, in this paper, an alternative world model is emphasized and applied to psychoacoustics, namely the perceptionist's model. Like realism, perceptionism has a long tradition in epistemology. It appears to be suitable to improve our understanding of perceptual organization.

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Investigation of relative vibratory detection thresholds on wrist

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In the paper relative values of vibration detection thresholds on two points on a wrist and index, middle and ring fingertips are presented. Measurements on fingertips were done to calibrate measurement setup and to find relative differences in thresholds for the wrist and fingertips. Palestesiometer P8 (Emson-Mat) was used as a measuring device. Measurements were performed in frequencies of 4, 16, 25, 63, 125, 250, 400 and 500 Hz. Two measuring probes were used: with diameter of 5 and 12 mm, working with the force 0.1 and 1.2 N, respectively. Both hands of women and men were investigated. Results show that hand and measuring probe size were not significant factors for fingertips thresholds. For the wrist not significant factors were gender and the place on the wrist. Thresholds found for the wrist were significantly higher than those for fingertips. Differences in threshold values were up to 20 dB in frequencies below 125 Hz. No statistically significant differences were found in results for sighted, blind and visually handicapped subjects.

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The problem of determining the orchestra pit acoustic parameters

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The paper presents results of acoustic measures performed in selected opera houses orchestra pit for the analysis of stage parameters (ST) and the sound strength (G). Analysis of collected data has allowed the development of research capabilities with the parameter G, while there were significant limitations on the applicability of ST. The article presents significant limitations of current methodologies used in acoustic research in orchestra pit and proposes opportunities for other research methods to enable a better assessment of the interior.

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The use of the idea of smart acoustics to acoustic climate management

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The implementing the climate-energy package is one of the most important factors determining the future of energy in the European Union, linked to the idea of Smart Cities. Taking into consideration the current projections, it can be assumed that by 2030 the urban population will double and will be around 2.64 billion. Hence, increase the residents' needs and requirements of these cities. It is therefore necessary to undertake intensive, integrated actions to the effective production and use of energy in each sector, while protecting the environment and improving quality of life. As a result of the idea of Smart Cities, cities will become more efficient and sustainable in areas such as transport, energy, information and communication technologies. The idea of Smart Acoustics allows such a broad of acoustic climate of agglomeration to reduce the adverse impact of noise on people staying in it. In the paper there has been briefly discussed some aspects of the two areas of noise and vibration threats occurring in the cities, that are mass events, and more commonly used of air conditioning equipment.

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Propagation of acoustic wave in polyatomic gases in high temperatures

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Presented work concerns the phenomena occurring during the propagation of acoustic waves in polyatomic gases at high temperature. The formula expressing acoustic waves velocity depends on the specific heat ratio at constant pressures c_p to a specific heat at constant volume c_v. In normal temperature κ is constant and is determined by the internal structure of the gas molecules. In high temperature vibrations of molecules begin to play an important role and the dependence of the specific heat at constant pressure and specific heat at constant volume on the temperature is obtained. In theses cases the dependence of acoustic wave velocity on the temperature is complicated. This subject contains important aspects of the development of modern aviation and rocketry technology.

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The effect of musical activity of listeners on their tuning ability

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In this work the effect of musical activity of listeners on their ability of tuning sounds was investigated. This ability is directly tied with the perception of pitch. The research on a large group of seventy listeners with variable degree of musical activity led to separate conclusions on the effects of musical education and musical activity. The effect of acoustic disturbances typically met during musicians' work on the quality of tuning was also examined.

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Experimental verification of computational simulation destined for received directional characteristics of panel sound source

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The paper describes an experiment carried out on the set of sound panels designed for generating high sound pressure level. The influence of arrangement of two sound panels on directional characteristic of the set was studied. Measured characteristics were compared with results received from model computation. This analysis showed compatibility of both received characteristics. Thus, one may say that proposed computer model makes it possible to predict the sound field of source in the form of various configuration of loudspeaker panels what facilitates the control of sound spread.

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Localization of amplitude-panned stereophonic phantom sources in the horizontal plane

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The localization of stereophonic phantom sources has been studied for decades. However, most studies were limited to the standard ±30 degree loudspeaker setup. This article reviews some experimental results and models for phantom source localization using amplitude panning on the standard loudspeaker setup, as well as on non-standard setups. By incorporating the directivity of human hearing, a model is developed that predicts the localization of broadband phantom sources for loudspeaker pairs at arbitrary directions on the horizontal plane. Moreover, the article investigates subjective differences in the localization of phantom sources and presents a way to predict these differences.

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Source width of frontal phantom sources: perception, measurement, and modeling

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Phantom sources are known to evoke perceptual differences compared to real sound sources. One of these differences is an increase of the perceived source width. This article discusses the perception, measurement, and modeling of the perceived source width for frontal phantom sources with different symmetrical loudspeaker arrangements. First, the perceived source width is evaluated by a listening test. The test results are compared to technical measures that are applied in room acoustics: the interaural cross correlation coefficient (IACC) and the lateral energy fraction (LF). Furthermore, an adaptation of the latter measure is developed to extend its application to simultaneous sound incidence. Finally, a geometrical model is presented for the prediction of the perceived source width.

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Statistical distributions of levels and energy of aircraft noise

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In many cases statistical distribution of random variable is nearly normal. The sound exposure level LAE measures the noise of sound events, such as aircraft operations or train pass-bys. The empirical mean estimates the central tendency of LAE distribution. Due to random nature of noise generation and propagation, this estimation is uncertain. If the statistical distribution of SEL is normal, then the standard deviation of LAE yields the exact measure of this uncertainty. Furthermore, in such a case one can define this uncertainty with the assumed confidence level. It

is shown in this study that both, the statistical distributions of sound energy e and the sound exposure level SEL of an aircraft noise, are not normally distributed. Since the classical method of uncertainty estimation is difficult to be applied in this case, we propose a new method based on the kernel density estimator (KDE). The paper presents an analysis of the distributions data, as well as elucidates the observed deviation from the normal distribution.

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Wavelet approach to RF signal analysis for structural characterization of soft tissue phantom

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To develop the theoretical and experimental basis for temperature measurement during heating of internal regions of soft tissues we would like at first to find an answer to the question what parameters characterizing the ultrasonic acoustic signal, being recorded during the heating, are significantly associated with the local temperature increase. First step is to study acoustic properties of self fabricated soft tissue phantoms by different approaches to proof efficiency of methods used in the future analysis, which will be more complicated in the case of heating. The paper contains the wavelet approach of registered RF signal transmitted by soft tissue phantom samples in the constant room temperature. Three phantoms with different structures have been measured. We claim that there is qualitative differences in the wavelets forms between phantom without scatterers and with seldom number of strong scatterers, while the large number of scatterers demonstrates qualitatively similar wavelet characteristics as phantom without scatterers.

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Pitch representation in the frequency following response (FFR)?

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In recent years, there has been increased interest in the scalp-recorded frequency following response (FFR), which is an electrical recording that reflects sustained phase-locking of a population of neurones in the upper brainstem to stimulus-related periodicities. It provides a non-invasive measure of neural processing in humans, which can be compared to behavioural responses concerning the listener's perception. It has been argued (e.g. Russo *et al.*, 2008) that the FFR reflects processes important for the perception of pitch and that changes in the FFR with experience and/or training provide a measure of neural plasticity at the level of the brainstem.

Several experiments will be presented, aimed at elucidating the origin and the specifics of the information present in the FFR. It will be argued that the neural responses measured by the FFR preserve temporal information important for pitch, but do not necessarily represent pitch-related processing over and abo ve that already present in the auditory periphery [Supported by Wellcome Trust Grant 088263].

Reference

1. Russo N.M., Skoe E., Trommer B., Nicol T., Zecker S., Bradlow A., Kraus N. (2008), *Deficient brainstem encoding of pitch in children with autism spectrum disorders*, Clin. Neurophysiol. 119, 1720–1731.

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The risk of noises environmental pollution in the shale gas harvesting

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The problem of fuel extraction in recent years is more and more acute. The discovery of large layers of shale gas in Poland caused the emergence of giant hopes to become independent of imported gas. It places great emphasis on exploration and exploitation of deposits of this fuel. At the same time it is said a lot about the impact of the technology used to extraction of this gas on the environment. Therefore, the authors decided to present an outline of environmental pollution and noise in the search and exploration of shale gas based on the technology of hydraulic fracturing. It has been also presented the proposed system of visualization of the environment.

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Modification of the measurement set-up to study the acoustic field of structures with cylindrical symmetry

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The paper points out certain difficulties one comes across when attempting to obtaining reliable measurement results in experimental studies on the cylindrical waveguide acoustic field, especially for some specific configuration of sources located inside the system. An appropriate modification of the measurement set-up is proposed allowing to avoid, to a considerable degree, the above-mentioned diffi-

culties and ambiguities. Theoretical considerations pertaining to acoustic field distribution inside a cylindrical "unechoic" duct and phenomena occurring at the duct outlet, based on mathematical models of infinite and semi-infinite waveguide, respectively, reveal that, for certain configurations of sources, acoustic pressure may vary rapidly along the duct axis. In the measurement practice this can result in significant errors and ending up with result contrary to expectations, e.g. absence of the anticipated axial symmetry of the field in case of axisymmetric excitation.

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Signatures and acoustic images of objects moving in water

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Observation of underwater space is part of a general trend, which primary purpose is to protect and increase safety in the selected area. The basic aim of the paper is presentation of designated acoustic characteristics typical for objects moving on the water surface and under water, which represent some knowledge about detection of these objects. Create a catalog of acoustic signature and not only acoustic, as well as acoustic images of objects, mainly objects moving under water, may be an important contribution to efforts to increase the security of water areas and the public facilities located in nearby vicinity. This is a part of general security policy with regard mainly to the type of threats of terrorism and sabotage, but not only.

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Ultrasonic studies of magnetic fluids: theoretical models and experimental results

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Magnetic fluids belong to a new class of magnetic materials that apart from properties typical to liquid, exhibit also week rigidity characteristic to solidlike media. Due to the possibility of remote controlling fluid's parameters using magnetic field, magnetic fluids have attracted considerable interest in their potential application in technological, biological and medical fields, such as seals, bearings, sensors, drug delivery, or magnetic hyperthermia. Recently, ultrasonic methods have been successfully applied to study different properties of magnetic fluids such as the particle (or aggregate) size distribution (PSD), level of anisotropy in external magnetic field or magnetic field-induced microstructure. The usefulness of the ultrasonic methods lies in their relative simplicity, non-invasive nature and thus in the possibility of performing the measurements in an intact, concentrated, dispersed system. In order to gain information on magnetic fluid properties from ultrasonic measurements the results of the ultrasonic studies have to be analyzed using appropriate theoretical model. One of such theory is based on the assumption that magnetic fluid can be treated as consisting of two phases: solid skeleton made of interacting clusters and fluid composed of carrier liquid with free magnetic particles.

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Ultrasonic and thermal measurements of magnetic nanofluid stabilized with dextran biocompatible layer

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Magnetic nanofluids consist of nano-sized iron oxide particles suspended in carrier liquid. Magnetic nanoparticles used in this study are coated by a dextran biocompatible polymer that shields them from the surrounding environment and can be functionalized by attaching carboxyl groups, biotin, avidin and other molecules. Magnetic nanoparticles have proven its use as cell magnetic separators, transport of antitumor molecules, for hyperthermal treatment and as contrast agent for nuclear magnetic resonance (NMR), among other biomedical applications. A method based on propagation of ultrasonic waves is used to measure the particle (or aggregate) size distribution (PSD). The ultrasonic results are analyzed using Winogradow theory. Also the heating rate of the magnetic fluids in the alternate magnetic field is measured. It is found that the heating effect is associated with a lag between the field and magnetization due to the relaxation nature of the magnetization process in magnetic fluids This make possible to describe the results of thermal measurements within the framework of Rosensweig theory.

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Structural noise reduction of a fluid-loaded smart structure

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In the present paper results of reduction of structural noise in fluid are presented. Resonant frequencies of circular fluid loaded plate were measured using swept sine technique on laboratory stand. The other side of the plate contains piezo elements used both as sensors and actuators. Actuators were used to generate vibrations of the plate and other to reduce sound pressure level in fluid, i.e. water and air. Results were compared with numerical calculations. Final

results reveal reduction of sound pressure level in fluid by more than 25 dB using only one piezo element.

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Special-purpose windows airborne sound insulation measurements

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Due to constantly increasing environmental noise levels, there is a need to build external walls with a relatively high sound insulation. If the building is located in the city center or near the large arteries, the required resultant external wall sound insulation is determined individually (based on the results of noise measurements in the vicinity of the building, then the calculations), and usually exceed the value of $R'_{A2} = 40$ dB. In case of marine windows or windows for the purpose of drilling platforms, sound insulation, required by shipowners, determined in the laboratory should be at least $R_w = 52$ dB. Obtaining a proper sound insulation of outside wall (or bulkhead) is associated primarily with the proper selection of materials from which wall (or bulkhead) is made of, but also its components, such as windows, and the technique and accuracy of installation is extremely important. Please note that the wall sound insulation is affected by insulation of all its elements.

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Complexation in aqueous systems of α-D-glucose and DMSO in the ultrasonic study

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Our investigations were concerned with the complexation processes in aqueous solutions of α-D-glucose and DMSO. The speed and absorption of ultrasonic waves were measured by a resonance method using the Resoscan TM System apparatus. Additionally, the density and the capacity in the investigated systems were measured, too. On the base of these data, thermodynamical parameters – such as molar volume, molar adiabatic compressibility and their excess functions, have been calculated. To be able to express the concentration of the ternary solution in mole fraction, the initial solutions of the water/α-D-glucose (water/ 6× α-D-glucose) ratio of 550/1 and of the water/DMSO at the same ratio, have been prepared. The composition of molecular complexes formed in the solution was determined on the basis of the correlation between the extremes of excess functions, ultrasonic absorption and the compositions of the mixtures.

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Correction of acoustics in historic theatrical halls with the use of schroeder diffuser

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The paper deals with the problem of acoustic correction in historic theatrical halls with the auditorium layout in the form of a horseshoe with deep sub-balcony cavities limited with vaulted wall surfaces. Both geometry of the cavities and excessive sound absorption determine acoustic phenomena registered in this area of the hall. The problem has been observed in the Opera Hall in Lviv, Ukraine, where acoustic tests were carried out, simulation calculations performed, and finally a diffusion panel worked out designed for the rear wall of the sub-balcony cavity. Acoustic measurements carried out after installation of the system of diffusers revealed favourable changes in the sound strength parameter G within the range of medium and high frequencies in the sub-balcony and auditorium centre area. By replacing textile tapestry with diffusion panels, a significant reduction of sound absorption was achieved for the frequency range above 1 kHz and increase of uniformity of acoustic parameters registered in the hall. It is worth mentioning that despite some earlier fears, the technocratic design of the Schroeder diffuser, after careful selection of the colour scheme, has ultimately won the acceptance of the artistic milieu.

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Noninvasive tissue temperature imaging by means of ultrasounds echo strain estimation

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Therapeutic and surgical applications of ultrasound require monitoring of temperature changes. For these purposes ultrasonic techniques would be the most preferred from an utility and economic point of view. In this paper an attempt to apply the estimation of echo-signals displacement for monitoring of temperature changes during ultrasonic heating of tissues in vitro is presented. The data obtained by ultrasonic measurements have been processed to determine a map of echoes displacements and compared with the temperature distributions measured by thermocouples. The obtained results enable evaluation of temperature fields and give a promising prognosis for combining the ultrasonic tissue heating techniques with tissues temperature estimation.

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How to listen professionally

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What is the professional listening? Sound/Acoustic Professionals listening categorized into three phases. The ability to discriminate between different sounds. The ability to correlate the auditory difference with the physical properties of sounds. And the ability to imagine the proper sounds when given the acoustic properties of the sounds. The ability could be trained through listening training. In this paper, as a listening training, Technical Listening Training in Kyushu University was described. Through trainings, trainees can share their experience. The shared experience reinforces trainees to express their auditory impression with coherent words. And the use of coherent words supports smooth communication in their group. This word co-herency is also the professional listening ability.

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Application of frequency and spatial compounding techniques for attenuation estimation in soft tissue

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The attenuation of the ultrasound within the soft tissue is often associated with pathological states which involve changes of tissue structure, like tumors. We are currently developing a technique for parametric imaging of attenuation and we intend to apply it for *in vivo* characterization of tissue. The method bases on tracking the spectral mean frequency shift resulting from the frequency dependence of the attenuation coefficient. The mean frequency lines are determined for each Radio Frequency (RF) line of the image data and next the attenuation profiles are estimated from the mean frequency shift. The high variance of the amplitude of backscattered echoes results in the variation of the attenuation estimates. In order to reduce the variation the spatial compounding and frequency compounding techniques were applied. These techniques effectively reduced the variation of the attenuation estimation, what was verified processing the simulated data and the echoes from the tissue mimicking phantom with uniform echogenicity but varying attenuation coefficient.

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Detection of selected emotion in speech signal

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The goal of the present study is to examine use of speech acoustic signal and eletroglottographic signal (EGG) for purpose of automatic emotion recognition. The authors focuses on examining the impact of speaker's emotional state on the course of laryngeal tone. An experiment was to simultaneously record both acoustic and EGG signal of speech without emotional features and speech signal with features of happiness, sadness and anger. For all recorded signals following parameters were estimated: fundamental frequency (f0), jitter, shimmer and additionally for EGG signals open quotient (OQ) and speed quotient (SQ). And also for the spoken words of test was calculated the time courses of the root mean square (RMS) and the dynamic spectrums from recorded signals. Statistical analysis of calculated results led to conclusions: both acoustic and EGG signal of speech are suitable for the identification of emotion in voice; it is possible to develop models of vocal expression of emotion characteristics for different states; not all emotional states combined with a strong vocal expression.

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A statistical approach in detection of noise events to aircraft noise assessment

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Long-term acoustical climate monitoring of the environment raises several problems related to large quantities of recorded data, which often represents information unrelated to the studied noise source. Manual verification of such data is time-consuming and costly. Therefore, to develop effective methods for automatic identification of transport noise sources (especially aircraft noise) becomes an important task for the proper determination of noise levels. In earlier authors' research to identification of noise sources and identify the type of airplane operations were used automated pattern recognition methods such as: artificial neural networks (Multi-Layer Perceptron, Adaptive Resonance Theory, Self Organizing Maps), minimum distance classifiers (Nearest Neighbor, k-Nearest Neighbor, Nearest Mean). In current research the probabilistic algorithm (statistical decision based on a threshold of discrimination) of classification was used. Acoustic pattern recognition method b ased on statistical decision has a 92% of correctness.

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Transmission properties of underwater acoustic channel

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Transmission properties of underwater acoustic channel are strongly conditioned by specific geographic location, and vary over time. In reliable communication systems, there is a need for adaptive matching of physical layer parameters of the data transmission signaling protocol. to instantaneous, often strongly varying, channel conditions. To achieve this goal, parameterized description of

the underwater communication channel is necessary. The paper presents results of impulse response measurements performed in a shallow-water, nonstationary channel, being then a basis for statistical characteristics of the WSSUS model of the time-varying, multipath channel. Transmission parameters were calculated, determining a design specification of physical layer of the communication protocol for a system based on the OFDM technique.

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Loudness scaling for normal and hearing-impaired listeners: from measurements in the past to present models and future applications

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Categorical loudness scaling can be used to assess the "recruitment" phenomenon in patients with a "compression loss" in inner ear function which is usually connected to a dysfunction of the outer hair cells. A pure inner hair cell loss, on the other hand, will cause a shift of the loudness function comparable to a pure "attenuation" loss. In order to make these characteristic changes in loudness function accessible to clinical usage, the following developments were performed that will be reviewed and discussed:

- A fast and reliable Adaptive Categorical Scaling procedure (ACALOS, Brand and Hohmann, 2002) was introduced which is available on a clinical audiometry workstation,
- Fitting functions and a connection to "classical" loudness models (such as, e.g., recent variations of the Zwicker loudness model using a transformation between sone and CU,
- In comparison to other psychoacoustical methods for estimating the compression loss in hearing-impair ed listeners, ACALOS appears to be very time-efficient and easy to use. It thus qualifies as valuable clinical & research tool to be used in audiology.

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Low-frequency rail noise risk in the environment

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In recent years in many countries, low-frequency noise – up to 200 Hz, has been regarded as one of the major environmental problems of human protection against excessive noise. For example, in accordance with the recommendations of the European Commission to be implemented in the near future, the ideas have been established among which there has also been the necessity to create a basis for assessment and mitigation of low-frequency noise in the environment. The research that has been carried out proved also that low-frequency noise emitted by the rail sources would not cause health problems but might be the source of many nuisances.

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Lightweight curtain walls with high sound insulation

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Fully glazed lightweight curtain walls are used both in public buildings with qualified acoustics, as well as housing, because of theirs aesthetic and constructions qualities. A major issue in the design of the building is to provide a sufficiently low sound levels in rooms, highly influenced by the sound insulation of the facade. The measurements of acoustic insulation of the three types of light curtain walls were made in the Acoustic Laboratory of the Building Research Institute (ITB). The results of laboratory tests have been discussed divided into single and double structures. Influence of construction of insulated glass has been described for the solutions with single glazing. The impact of an aluminum frame, ventilation shutters and way of glazing on the sound insulation of lightweight curtain walls has been discussed.

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Soft tissue in vitro heating by ultrasound beam and acoustical properties of soft tissue phantoms

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The paper presents preliminary results of measuring the temperature inside the tissue in vitro during the process of heating by the ultrasound beam with low power and measuring the acoustic properties of soft tissue phantoms. These models were built to further research into the link between the temperature of the acoustic properties, because in vitro tissue samples proved to be unique and unstable. The three tissue phantoms answer to pulse excitation were measured and pulse propagation velocity, attenuation and statistics of signal envelope have been examined. The influence of the number of scattering elements on the obtained parameters is discussed.

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Influence of material used for regenerator on properties of a thermoacoustic heat pump with traveling wave

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Acoustic wave propagating in a gas is described by changing the pressure and the oscillating motion of the particles, but there is another important factor – the oscillating heat. Research in the thermoacoustics began with the observation of the heat transfer between gas and solids. These interactions are too small to have been seen in the sound

wafting in the air-rated through which we communicate every day. The term thermo-acoustics was defined by Nikolaus Rott, who explained it as a combination of two thermal and acoustic phenomena. The intense sound wave and the pressure in the thermoacoustics can be used to create: powerful engines, heat pumps and thermoacoustic refrigerators.

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Recognition of musical instruments in polyphonic recordings for mean, mode, and median-based sound parameters

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In this paper we describe experiments on the recognition of musical instruments in polyphonic recordings using random forests as classifiers. The feature vectors applied to parameterize the analysed sound segments are based on means, modes, and medians of short-time sound features, calculated through the entire segment. The results of these experiments are presented and discussed in this paper.

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Resonance model of the human tissue used in surgery simulator

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During the real robotic surgery, there is a wide range of contacts of surgical instruments with live tissue. The behavior of biological tissues as volumetric objects differs substantially from the physical materials, i.e. those where the degree of deformation is small. The development of reliable mathematical models of soft tissue enables to create virtual training tools used in minimally invasive surgery, where the key role is played by a simulation of phenomena occurring in real surgery. In this paper the properties of the model tissue with a reduced dynamic, which was subjected to simple and complex deformations. Built on the base of the model virtual organs are part of a training system developed for conducting virtual operations (training) using the surgical robot ROCH-1.

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Comparison of numerically calculated pressure drop for selected helicoidal resonators

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This paper presents the comparison between numerically obtained pressure drops for helicoidal resonators with the same ratio $s/d = 1.976$ and other dimensional relationships, but different number of helicoidal turn $n = 0.671$ and $n = 0.695$, as well as $n = 1.0$. Acoustic system of straight cylindrical duct with helicoidal resonator inside is considered. Two modules of Comsol Multiphysics numerical environment were used to solve air flow problem: aeroacoustics with flow and CFD Turbulent Flow. Air flow velocities between 1 m/s and 20 m/s with the step of 1 m/s were applied. Observed difference between aeroacoustical and CFD results tend to conclusion that experimental measurements of pressure drops should be done for all cases.

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Demands on measurement models for the perceptual qualities of virtual acoustic environments

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Virtual acoustic environments (VAEs) are frequently intended for the reproduction of and the interaction with acoustic scenes. While different technical approaches such as sound field synthesis and binaural synthesis vary in their capability of accurately reproducing certain features of the physical sound field, there is no agreement as to the perceptual criteria for the evaluation of VAEs. Frequently suggested global attributes such as presence, authenticity, plausibility and naturalness are reviewed. We propose a systematization of different properties, discuss the suitability for different research objectives, and consider demands for their measurement. In this context, methodological issues regarding operationalization, experimental references, and criterion-free test procedures are discussed.

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Auralisation quality estimation

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This paper shows the set of parameters meant to establish "how good" the auralisation is. The basic concept is to compare actual reverberant room acoustic with its auralisation. The measurement of first-order ambisonic impulse response is provided both for the actual room and its auralisation. The article shows the results of comparison and analysis of significant factors that influence quality of auralisation.

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Nonlinear active noise control of sound transmitted through a plate

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Active Noise Control (ANC) of noise transmitted through a vibrating plate causes many problems not observed in classical ANC using loudspeakers. One of the

problems is related to nonlinearities existing in systems using vibrating plates. Those nonlinearities are due to nonlinear vibrations and use of nonlinear actuators, like MFC patches. In case of noise transmission though a plate, nonlinearities exist in both primary and secondary paths. Existence of nonlinearities in the system may degrade performance of linear feedforward control systems usually used for ANC. The performance degradation is especially visible for simple deterministic noise such as tonal noise, where very high reduction is expected. Linear feedforward systems in such cases are unable to cope with higher harmonics generated because of nonlinearity. Moreover, nonlinearities, if not properly tackled with, may cause divergence of an adaptive control system. In this paper a feedforward ANC system reducing sound transmitted through a vibrating plate is presented. The ANC system uses nonlinear control filters to suppress negative effects of nonlinearies in the system. Filtered-error LMS algorithm, found more suitable than usually used Filtered-reference LMS algorithm, is employed for updating parameters of the nonlinear filters. The control system is experimentally verified and obtained results are reported.

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Computer simulation of active sound intensity vector field in enclosure of irregular geometry

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The modal expansion method has been used to formulate expressions for real and imaginary parts of the complex sound intensity inside enclosures. Based on theoretical results, the computer program has been developed to simulate the active intensity vector field inside L-shaped enclosure. Calculation results have shown that a distribution of the active intensity is strongly influenced by the modal localization and the typical objects in the active intensity field are energy vortices and saddle points positioned irregularly inside the room. It was found that an increase in a sound attenuation results in the change of vortex positions and can cause the formation of new vortices. An influence of the wall impedance on the quantitative relation between the active and reactive intensities was also studied and it was concluded that for very small sound damping the behavior of the sound intensity is basically only oscillatory.

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Music-induced vibrations in a concert hall and a church

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Sound and vibrations are often perceived via the auditory and tactile senses simultaneously, e.g., in a car or train. During a rock concert, the body vibrates with the rhythm of the music. Even in a concert hall or a church, sound can excite vibrations in the ground or seats. These vibrations might not be perceived separately because they integrate with the other sensory modalities into one multimodal perception.

This paper discusses the relation between sound and vibration for frequencies up to 1 kHz in an opera house and a church. Therefore, the transfer function between sound pressure and acceleration was measured at different exemplary listening positions. A dodecahedron loudspeaker on the stage was used as a sound source. Accelerometers on the ground, seat and arm rest measured the resulting vibrations. It was found that vibrations were excited over a broad frequency range via airborne sound. The transfer function was measured using various sound pressure levels. Thereby, no dependence on level was found.

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Measurements of the CMDP and DPOAE signals in guinea pigs

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Acoustic wave excitation of the cochlea consisting of two tones with frequencies f_1 and f_2 evokes the answer of the hair cells in the form of the cochlea electrical signal CMDP (Cochlear Microphonic Distortion Product) and the acoustic signal DPOAE (Distortion Product OtoAcoustic Emission). The frequency of these signals was $f_3 = 2f_1 - f_2$. For many years the DPOAE signals is used in experimental examinations of the cochlea of the inner ear, as well as in clinical diagnosis. Only in a few articles you can find information on the use of CMDP signals. Simultaneous measurement of both signals, for different parameters of stimulation, offers new opportunities for cognitive physiology of the inner ear. The article presents the first results of measurements of the both signals (CMDP and DPOAE). Measurements were performed in three young, healthy guinea pigs. The results show clear evidence of significant differences between the DPOAE-gram and CMDP-gram in the studied range o f frequency f_3 [500 Hz, 5310 Hz].

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Acoustic properties of classrooms in primary schools – estimating the speech transmission index from the reverberation time

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Among the parameters determining the acoustic properties of classrooms, the speech transmission index STI is

the most correlated with the subjective feeling of speech intelligibility. However it is not widely used because of the time consuming method of measurement and the need for specialized equipment. The most commonly used parameter characterizing room acoustics is reverberation time. The relationship between these two parameters is not clear and it is still not specified for the considered rooms. The article presents the relationship between speech transmission index STI and the reverberation time in octave frequency bands, based on data from 126 primary school classrooms.

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New acoustical parameters and measurement methods of floor coverings

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This paper presents two new laboratory measurement methods of walking noise, which is being radiated during walking from the floor into the room containing the test sample. Mentioned methods are as follows:

1. Developed by European Producers of Laminate Flooring described in paper EPLF 012019-6.
2. Described in European standard proposal Fpr EN 16205:2011.

Floor covering parameters related to radiated sound of walking derived using abovementioned methods have been discussed, as well as several results of test measurement conducted according to the Fpr EN 16205:2011 method have been presented.

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Effect of climate change in a small room on the results of acoustic measurements

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Computer programs are increasingly used in designing room acoustics, but the problem of determining the reliability of these simulations are so far unresolved. It is necessary to determine both the acoustic measurement and simulation results uncertainties in order to determine the degree of divergence of simulation results with actual values measured in the room. The essential input data for modeling room acoustics are climate conditions (temperature and relative humidity). These values are often variable and therefore their exact definition is difficult and sometimes even impossible. Therefore, it is useful to know about how the final result of modeling is influenced by an uncertainty of the determination of these input values. The hereby paper examined how changes in temperature and humidity affect on the results of measurements parameters: T30, EDT, C80, D50, STI and SPL.

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Varieties of masking of speech: energetic, modulation and informational

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There are often situations where it is necessary to listen to speech in the presence of background sounds. Such sounds can reduce speech intelligibility, which will be referred to as partial masking of the speech. The masking of speech can take three forms: (1) "energetic" – the masker "swamps" the internal response to parts of the speech; (2) "modulation" – the amplitude fluctuations in the masker make it more difficult to detect and analyse the information-bearing amplitude fluctuations in the target speech; (3) "informational" – the auditory system has problems in deciding which parts of the input sound emanated from the target speech and which parts emanated from the background. In experimental work, a commonly used masker is a notionally steady noise with the same long-term-average spectrum as speech. This has traditionally been regarded as an energetic masker. However, Stone, Füllgrabe and Moore (2012) showed that the inherent random amplitude fluctuations in such a noise play a critical role, and that such noise is more appropriately described as a modulation masker. A truly steady but energetically similar masker, composed of multiple inharmonically spaced tones, produces much less masking than a noise masker. Informational masking of speech occurs most commonly when the background consists of one or more competing talkers. However, such masking can occur for non-speech backgrounds with speech-like characteristics (Chen *et al.*, 2012). Also, the informational masking produced by a background talker can be small when the target speech material has a highly predictable structure (Lunner *et al.*, 2012).

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Investigation of physical phenomena in two-dimensional phononic crystals using ultrasonic waves

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In this paper an experimental approach to the usage of phononic crystals as focusing lenses by investigating both the negative refraction effect and existence of phononic band-gaps in two-dimensional structures consisting of steel rods immersed in water is presented. The negative refraction behavior has been demonstrated for both square and triangular lattices. Achieved results allow considering further studies in the field of both focusing and imaging using phononic crystals.

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Ultrasonic transmission tomography imaging of CIRS Model 059 Breast Biopsy Phantom structure in comparison with USG, CT and MRI

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In the paper, the results of the ultrasound transmission tomography imaging (UTT) of the internal structure of CIRS Model 059 Breast Biopsy Phantom were analysed and compared with the imaging results by means of the ultrasonography (USG), the computerized X-ray tomography (CT) and the magnetic resonance tomography (MRI). It is impossible to observe any differentiation of the internal structure of that phantom on USG images. The obtained results of the investigations indicated, that the applied ultrasound transmission tomography (UTT) method can be used for the detection and diagnosing of tumor changes in the women breast.

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A right time and place for pitch perception?

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Pitch is a primary auditory percept, and one that has been studied extensively for well over a century. The quest to understand the neural mechanisms of pitch has gained more urgency recently, as pitch deficits are often particularly in striking in people with hearing loss and cochlear implants. This talk will provide a survey of research into pitch perception, and will highlight recent progress in the field that relates to the long-standing question of how tonotopic (place) and temporal (timing) information in the auditory periphery is used in pitch perception.

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An attempt to identify the acoustic quality in urban environment

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The subject discussed here is a continuation of the research on identifying the features of soundscapes in the Urban environment. The idea of soundscapes has been gaining a greater interest in the approach to acoustic ecology, which to a significant extent makes use of the aspect of perceiving sound as a subjective assessment of noise nuisance. In this context, the condition of noise threat is a resultant of a qualitative and quantitative representation of acoustic and non-acoustic features of an urban environment. The research done in this field shows that the qualitative features of representing and assessing the environment are not well recognised. Research on the acoustic quality of the environment using the entropy method is presented in this paper. The paper presents an example of the method of examining the emotions induced by sound sources using the entropy method, taking into consideration the sensory stimuli.

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The auditory filter representation of cochlear processing in humans: past, present and future

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This paper describes the progress of auditory scientists over the years in their attempts to specify the shape of human auditory filter, that is, the frequency resolution of the auditory system at each point along the tonotopic dimension of the cochlea. Early, behavioural experiments revealed that the auditory filter had a rounded top flanked by exponential skirts – a roex auditory filter. Physiological experiments with cats suggested that the impulse response of the filter had a gamma envelope with a sinusoidal carrier – a gamma-tone auditory filter. Subsequently, behavioural and physiological experiments revealed that the filter shape changes with sound level, which led to the conclusion that the carrier under the gamma envelope must chirp – a gammachirp auditory filter. Finally, the efforts of auditory scientists prompted research on the mathematics of auditory frequency analysis, and we now know that the gammachirp auditory filter is mathematically optimal in the sense that it provides minimal uncertain in linear-time, log-frequency analysis, just as the Gabor function provides minimal uncertain in linear-time, linear-frequency analysis. The fact that the auditory system uses log rather than

linear frequency suggests that it is more concerned with the source-size information in sounds than with frequency per se.

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Nonlinear features of sound propagation in relaxing media

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Nonlinear features of sound in relaxing fluids are studied. Among other, viscoelastic biological media described by the Maxwell model of the viscous stress tensor, gases with excited degrees of oscillatory freedom of molecules, and chemically reacting media belong to this type of flu-ids. The governing equation of sound is derived by means of the special linear combining of conservation equations in the differential form, which allows to reduce all non-acoustic terms in the linear part of final equation and to hold only dominative non-linear terms associated with sound. It is discovered, that while propagation of the high-frequency sound, the parameter of nonlinearity of the Maxwell fluid increases.

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Alternative methods for data collection to elaborate acoustic maps

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Acoustic maps are the basic instruments to assess and manage the level of noise in the environment. On their basis plans of actions are worked out. Those plans are the basis in management of noise issues, which includes conducting the organisational operations as well as implementing the technical measures for noise limiting. All those actions require significant expenditures. Therefore, it is important to guarantee proper deduction on the basis of prepared acoustic maps. This idea is directly connected with collection of correct and up-to-date input data. Among them spatial information should be mentioned. This area of data includes Digital Surface Models (DSM). Generally they are elaborated on the basis of Orthophotomaps. The accuracy and timeliness of DSM depend on precision of Ortophotomaps. Generally the process of obtaining Ortophotomaps is realized with use of Aerial or Satellite Imagery. Unmanned Aerial Vehicle (UAV) is a new alternative method for that. It provides fast and cheaper process of collection of data about terrain. Legal regulations connected with application of UAV are presented. What is more, basic requirements related to preparation of Ortophotomaps are discussed. The range and the method of testing are also given.

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The influence of well's bottom shape on effectiveness of Schroeder diffusers

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Phase grating sound diffusers (QRD) were invented by Schroeder in 1979. Thanks to omnidirectional characteristic of directivity of reflected sound and very easy design, they became very popular. Nowadays they are used in small spaces like control rooms as well as in a big concert halls. Acousticians wanted to obtain wideband diffusion, what lead them to construct very deep and narrow wells, which give big absorption at low and medium frequencies. Because of that, a great area of wideband QRD cannot be used in concert halls. Other popular way of widening the range of effective diffusion of QRD is to shape properly the bottom of their wells to make a kind of fractal diffuser. In the paper some methods of shaping the bottom of wells are shown and its influence on directional sound diffusion coefficient d is presented. The analysis of results shows, that presented methods significantly improves diffusion coefficient especially for mid and high frequency.

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A software system for off-site timbre solfege with remote results management capability

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This paper describes a flexible networked system that combines testing and training of auditory abilities. The system consists of two parts: a user-side test unit ("a client") and a remote data storage unit. For efficient data storage and analysis the system uses remotely accessed MySQL database. The client-side program performs the actual listening tests and connects to a database server through the Internet to upload user results. The client is a standalone Windows application designed to run on various personal computers, including netbooks, and is capable of working with a wide range of computer audio interfaces. An unlimited number of listeners, each using his/her own copy of the test unit, can be trained or tested, even at home, in a convenient time, while their performance is under control of an instructor or experimenter, and the progress of training over time can be monitored easily, by accessing data storage module. Results stored in a database can be browsed us ing general-purpose MySQL clients, which provide various methods of data manipulation useful to select interesting subsets of the listeners' results. At present three types of tests are fully implemented: test of sound equalization recognition, frequency and waveform recognition, as well as dynamic range compression. Each area consists of various tasks, either with predefined difficulty levels or with freely adjustable parameters.

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Ultrasonic noise – determination of exposure levels at workplaces with ultrasonic welders

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One of the most common ultrasonic devices in the working environment are ultrasonic welders. They emit impulse noise very often with high levels exceeding MAI values. The level of ultrasonic noise exposure at workplaces with welders is closely related to the number of produced components, and the sound pressure levels during welding. The paper presents some problems of determining the level of exposure to ultrasonic noise at workplaces with ultrasonic welders including the measurement uncertainties.

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The concept of the underwater encrypted communication system

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This article presents the initial concept of the underwater encrypted communication system. A block diagram of the system We be presented and reflections on the various functional blocks will be discussed. An overview of underwater acoustic modems available on the market will be shown as well.

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Analysis of the influence of uncertainty determination of sound absorption coefficient of the audience on the accuracy of prediction of the reverberation time in concert halls

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In the paper, analysis of dependences that allow to calculate uncertainty of determination of the reverberation time in rooms was carried out. Based on the propagation of uncertainty, dependence of the maximum sound absorption coefficient of the audience on the assumed tolerance range of room reverberation time was determined as well as the range of its application. Basing on presented dependences, method for calculating sound absorption coefficient of the audience and determination of its variation range for assumed tolerance of reverberation time was proposed. Presented method allow to select seats for the audience at the stage of designing interior acoustics. Analysis of the application was conducted based on three concert halls.

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Simulation studies of planar microphone arrays

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The results of computer simulations of irregular planar microphone arrays have been shown. Arrays were studied consisting of 64 microphones on a frame-like square with sides of about 1.9 m. The simulations have shown that it is possible to adjust parameters of the arrays to the metrological requirements, in particular a resolution, a dynamic range, an angular extent of essential noise sources and a frequency spectrum of a signal.

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Compression of auditory space during uniformly-accelerated forward self-motion

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Spatial inputs from the auditory periphery can be changed with listener's various movements relative to the sound source. Nevertheless, humans can perceive a stable auditory environment and appropriately react to a sound source. This suggests that the inputs are reinterpreted in the brain, while being integrated with information on the movements. Little is known, however, about how these movements modulate auditory perceptual processing. We investigate the effect of the linear acceleration on auditory space representation. Participants were passively transported forward/backward at constant accelerations An array of loudspeakers was aligned parallel to the motion direction. A short noise burst was presented during the self-motion from one of the loudspeakers when the listener's coronal plane reached the location of one of the speakers (null point). The results of the experiments showed that the sound position aligned with the subjective coronal plane was displaced ahead o f the null point only during forward self-motion and that the magnitude of the displacement increased with increasing the acceleration. These suggest a distortion of the auditory space in the direction of movement during forward self-motion.

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Doppler effect in underwater acoustic system

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The paper contains an overview of the Doppler effect in underwater acoustic systems. Review is preceded by a discussion of the Doppler effect in the category of time compression. Subsequently the Doppler methods used to measure the velocity and position of the observed objects are

presented. Afterwards the Doppler phenomenon in the synthetic aperture sonars is described. In the second part of the paper the negative consequences of the Doppler effect and methods of their limitations in conventional and silent sonars are discussed.

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Sonodynamically induced in vitro C6 glioma cancer cells damage enhanced by aminolevulinic acid (ALA)

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Sonodynamic therapy is expected to be a novel therapeutic technique for glioma tumors. To determine the effect of ultrasound and aminolevulinic acid (ALA) on the cancer cell damage, we exposed C6 glioma cells to 1 MHz ultrasound at intensities 0.94, 1.88 and 3.77 W/cm^2 for 3 min. We found that combined ALA + ultrasound therapy (15%–13% living cells) is more efficient than ultrasound alone (41%–27%) at intensities 0.94 and 1.88 W/cm^2. 3.77 W/cm^2 ultrasound was efficient to kill most cells independently on ALA added. Standing wave was observed increasing acoustical intensity by factor $7\times - 10\times$. The results might be useful for efficient sonodynamic tumor therapy.

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Investigation of ultrasonic emulsifying processes of linseed oil and water mixture

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Ultrasonic emulsifying processes of immiscible liquids can be used to obtain stable emulsions. The authors used ultrasonic sandwich head with energy concentrator to obtain suitable value of energy density necessary for ultrasonic cavitation emerge. Two piezoelectric rings (D_{ext} = 50 mm) transducers Pz-26 type produced by FERROPERM were used to design of ultrasonic sandwich head. The frequency ultrasonic wave was 18.4 kHz and time of ultrasonic transducer exiting 5 and 10 minutes. Visible bubbles during generation of ultrasonic waves in mixture appeared after exceed cavitation threshold. The authors determined also cavitation threshold by measure electrical voltage conducted to transducers. To receive durable emulsion the electrical voltage attained 300 V_{peak}. The dispersion dependence on time emulsifying was determined. Emulsion of linseed oil and water was stable through some months without surfactants.

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Exposure to ultrasonic noise at metal finishing workstations

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This article contains a measurement method and criteria for assessing exposure to ultrasonic noise at workstations. The results of measuring ultrasonic noise and risk assessment related to occupational exposure to ultrasonic noise are presented to workstations where noise is occurring as unintentional results of production process (so-called not technological sources of ultrasonic noise). The measurements were conducted during external machining of elements and engraving, oxy-acetylene welding, electrical welding, cutting and burning.

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Tonality as a one of the fundamental properties of music perception

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An important feature of the perception of numerous audio waveforms used in music for people with developed relative ears is the dependence of the perception of musical sensation at the given moment on the context preceding the moment. This phenomenon will be referred here to generally as the tonality. Tonality thus understood is, among others, underlying the development of European music of the late nineteenth century and it is conceivable that it is going to play an important, perhaps even a fundamental role in the development of music and music theory in the future. A complete theory of perception of auditory sensations – should such a theory be ever created – should include a mathematical description of tonality perception. The aim of the authors of the article is to provide the most general model of the perception of aforementioned attribute of auditory sensation. The article outlines the characteristics of the created model and provides the prospects for its further development. The paper on the subject of this article will be illustrated by relevant sound examples.

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Content based audio watermarking in DWT domain

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In this report, I propose a digital audio watermarking method based on re-quantization of discrete wavelet coefficients. Re-quantization is applied to the relation of power

averages of the detail coefficients sequence in a certain decomposition level. It is expected that the deviations are not to be varied against the attack as long as sound quality is not severely degrade before attack. Moreover, all of payloads are embedded simultaneously to every position of a certain decomposition level in wavelet packet transform domain. Robustness and perceptibility are evaluated through some computer simulations.

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Sensitivity analysis of the acoustic field parameters in the room on change the boundary conditions

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The area of environmental protection concern is to minimize the impact of technical objects to the environment. Usually the most effective action to protect are those made "at source". For this reason, studies are conducted to modify the construction of machines, power machines, in particular, so as to minimize their impact on the environment. In the case of environmental protection from noise is most convenient to carry out tests in an anechoic chamber. Therefore it seems advantageous to develop a method to obtain similar and reliable results as in an anechoic chamber, but in thereverberant field. The main objective of this work is a comprehensive analysis of numerical model of a laboratory designed to acoustic tests of the selected energetic machines. The geometry of the room comprising an area of analysis is easy to project. The main difficulty in modeling the phenomena occurring in the analyzed area can be given a lack of knowledge of boundary conditions. Therefore, the authors have analysed the sensitivity of some acoustic parameters of the room on change of sound absorption coefficient.

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Role of 4–8 kHz one-octave band component for median plane sound localization

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In contrast to horizontal plane sound localization, for which interaural cues play important roles, median plane localization is mainly determined by spectral cues, which represent the spectral shape inputted to the ears characterized by the incident angle of a sound. To clarify spectral cues involved in HRTF in the median plane, we conducted a sound localization test with broadband noises with different one-octave band levels for 4–8 kHz band. To generate these noises, pink noise was filtered so that the one-octave band level varies from −6 to +6 dB. The noises were radiated via one of two loudspeakers located at 30 and 60 degrees of elevations, respectively, in the median plane. As a result, the perceived elevation was shifted according to the band levels. The changes of perceived elevation resembled those of relative power levels in the HRTFs. This suggests that the spectral dips in the HRTFs whose frequency systematically changes as a function of the elevation would be an indirect perceptual cue but that the relative level of this band would be a direct perceptual cue for elevation perception.

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Guidelines for the revision of national standards for building acoustics

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The paper presents trends in a series of amendments and additions to the standards PN-B-02151 "Building acoustics. Protection against noise in buildings". These standards apply to residential buildings, housing and public buildings and currently includes 3 parts:

- general requirements and the technical means of protection against noise in buildings,
- required noise level in rooms
- requirements for sound insulation in buildings (internal and external).

Standards covering the above issues from 1987 and 1999 and a number of provisions contained in these standards has become outdated because of changes in other standards and documents involved. Regardless of your experience with the use of these standards indicate a need for a number of changes and clarifications. A set of standards does not include requirements for the protection of reverberant noise introduced into the polish regulations and requirements for residential buildings with a higher standard acoustic. These issues must be made by the establishment of new parts of PN-B-02151.

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Proposed acoustical classification of sound residential buildings (apartments)

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Ensuring adequate acoustic comfort at home is an important social, technical, technological and economic pro-

blem. The needs of individual people in ensuring the acoustic conditions in the apartments are very diverse. In a market economy on the approach to this issue also have a big impact economic aspects, both in terms of the whole country as well as individual families investing in their own apartment. For this reason, the requirements for acoustic comfort should be graded from a level that ensures a minimum (due to physical and mental health of the population) acoustics in the place of residence up to the higher levels corresponding to higher needs in this area. Transfer to a diverse technical language requirements for acoustic comfort at home means to determine acoustic requirements for buildings with a higher (in varying degrees), standard sound and how the acoustic classification of objects according to the adopted higher minimum.

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Assessment of left ventricular model strain measurement obtained by means of ultrasonic speckles tracking method

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In the contemporary ultrasound elastography exists the problem of the repeatability of the parameters measured by using the ultrasound apparatus made by different producers. In this work the new method for assessment of the quality of the ultrasonic speckles tracking method is proposed. Experiments were carried out using Artida Toshiba ultrasonograph with probe 3.5 MHz. The hydraulic model was based on the SuperPump (Vivitro Systems Inc. Canada). The Left Ventricular (LF) phantom (Fig. 1–2) is made as 10% solution of the POLY(VINYL ALCOHOL), 99% HYDROLYZED (M. 1,000 1.219,34/EA 1.219,34 23,0) (longitude 10 cm, inner diameter 3 cm, outer diameter 5 cm). During cycle of the pump, the Sample Volume (SV) of water is going to the inside of the LF phantom and return to the pump, providing changing the inner and outer diameters of the LV phantom. The SV was changed 8, 16 and 24 ml. Heart rate was changed from 40 to 120 b.p.m. for each SV. The parameters examined were: Radial Strain, Circumferential Strain, for two positions of LV phantom: 1) 0 deg and 2) after turn left the LV phantom of 25 deg. The nonparametric U-test Mann-Whitney was used for confirmation that for 0 deg and 25 deg not exist any significant statistical difference between measured parameters. For all cases the level of the coefficient of significance was $p > 0.05$. The results of statistical analysis indicate that the change of the acquisition angle not influences on measured above parameters. It may authenticate the applied ultrasonic speckles tracking method implemented in ultrasound.

This work was supported in part by Polish National Centre of Science (project N N518 292340).

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Comparison of efficiency of homogeneus and two-layer piezo elements in plates vibration reduction – numerical study

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This paper presents the results of numerical studies on efficiency of different structures of piezo elements used as actuators. For this purpose numerical models were created with ANSYS software that contained steel plate clamped on all sides with piezo elements attached. Four elements as sensors, one for vibration excitation and four as actuators. For each model sensor and actuators are always cuboid elements, while actuators differ in shape and structure for different models. Harmonic analyses shown that, two-layer piezo elements can be much more efficient in reducing the vibration than homogeneous ones independently of the shape of elements used.

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Virtual room acoustics

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Room acoustic auralization has been developed from simulation algorithms and binaural technology in a historic process of more than 20 years. Full-immersive Virtual Reality (VR) systems, such as CAVE-like environments, have been in use for about 15 years. The link between simulation and auralization is the representation of the problem in the signal domain and the treatment of sound and vibration by signal processing. Apart from the simulation process, the so-called called "rendering", the development of audio reproduction of acoustic stimuli in VR is now at a stage where integration of 3D sound is in the focus of general interest. This applies to binaural synthesis as well as to full room-acoustic simulation algorithms and to various applications of 3D sound stimuli. In this presentation the state of the art is summarized, and the contribution of the Institute of Technical Acoustics in Aachen to this field is illustrated in examples.

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Sound intensity methods and laser anemometry techniques in the studies of sound emission in cases of acoustic disturbed flow

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The birth of sound in hydro and aeroacoustics flow is still not clearly described theoretically and verified experi-

mentally. The paper will present the current views on the origins of sound occurring in physical systems, which typically examine the numerical modeling (numerical study of a group of models, CFD, FSI and CAA) adapted to the theory of Vortex Sound Theory. It will show the results of acoustic studies of flow fields generated in limited systems (acoustic waveguides) and the acoustic near-field regions, where the reactions are the effects of nonlinear wave amplitude-phase compounds. Performed experimental studies on the graphic description of the vector of parameters of the acoustic field generated by the flow of acoustic waves in regions of the obstacles and ambiguous. Research is conducted using the measurement of sound intensity (SI) and the currently developed non-invasive methods of laser anemometry (PIV – Particle Image Velocimetry and LDA – Laser Doppler Anemometry) adjusttion to the study of acoustic (A-PIV, A-LDA). The use of laser methods for testing acoustic flow is shown as the own preliminary results. The results of experimental tests parameters of the acoustic wave vectors (sound intensity and particle velocity) showing the energetic phenomena occurring in the acoustics flow fields confirm the crucial importance of innovative measurement techniques in the development of knowledge of the sound theory and point to their usefulness in conducting validation of the theoretical results of numerical models.

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Effect of contralateral speech-in-noise on the level of the distortion product otoacoustic emissions (DPOAES)

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The main objective of this study was to determine the influence of contralateral speech-in-noise on the level of distortion product otoacoustic emissions (DPOAEs). Two types of contralateral signals (CS) were used in the study: speech presented against a babble masking noise and the babble noise without speech signal. The CS was presented at a level of 60 dB SPL. The signal-to-noise ratio (SNR) was a speech reception threshold (SRT). The primary tones with frequencies f_1 and f_2 ($f_2/f_1 = 1.21$) were generated at levels of $L_1 = 60$ dB SPL and $L_2 = 50$ dB SPL. Ten normal hearing subjects participated in the study. The CS produced a decrease in the level of the DPOAEs (suppression effect) in 88% of cases for f_2 changing from 1000 to 8000 Hz. The suppression effect was higher for babble noise without speech signal than for speech against a babble masking noise. A within-subject analysis of variance (ANOVA) revealed a significant effect of CS type:

$$F(1, 9) = 9.66, \qquad p = 0.013.$$

This work was supported by a grant from the National Science Centre No. N N518 405438.

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Application of shape memory elements to excitations or reduce vibrations of mechanical structures an example cantilever beam

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Materials with shape memory are alloys or polymers capable in certain conditions to return to its previous "Memorized" shape. In engineering practice, most widely used alloy is nitinol, which is alloy of nickel and titanium. It has two stable phase, the shape change occurs by changing the phase low-temperature (martensite) at high temperature (austenite) or *vice versa*. In engineering, the most commonly used of this material: actuators, switches and sensors. The actuator can be used as a vibration exciter, if only enforce its work with the appropriate frequency. In this work the shape memory alloys are used in this way. Performed research has shown the ability to force cantilever steel beams to vibration. Research of controlling the movement was made: offset response structure in the frequency domain and reduce or enhance the movement for a specified range of frequency.

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Perception and evaluation of sound fields

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Sound field synthesis techniques claim to recreate a desired sound field within an extended listening area. In order to investigate the perceptual properties of the synthesized sound field the listener has to be placed at different positions. In practice that can be quite difficult with real loudspeakers. Another possibility to perform listening tests is to present the field via binaural synthesis. This study investigates whether binaural synthesis is perceptually transparent for the purpose of localization studies for sound field synthesis. A localization test is performed comparing real loudspeakers to two different binaural synthesis configurations using non-individual head-related transfer functions (HRTFs), once with and once without reflections. The results show only slight differences between real speakers and HRTFs-based synthesis, resulting in a one degree greater localization blur for the HRTFs without reflections than for the other two cases.

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Spherical sound panorama

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Directivity of sound field in measurement place is one of the most important characteristic during environmental measurements in open space. The detection of arriving

sound direction is a first step in data pre-selection in automatic monitoring system. Such technique can be used to follow e.g. airplanes or car traces and indication of their influence on measured noise. It is necessary to use specialized microphones in order to receive spatial information about sound sources localization. Results from SoundField ST 350 microphone system recordings are presented on spherical panoramas where each type of noise source is indicated using different shape and color. For evaluation of spatial recordings and for noise measurements documentation the 16 loudspeakers auralization system is proposed. A complete 3D sound measurement, visualization and reproduction system with procedures of data acquisition, processing and visualization will be the main results of investigations. The idea of such system and first results are presented in the paper.

The work was financed by The National Centre for Research and Development (project no NR03 0030 06/2009).

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The effect of a mode of playing on spectral parameters of the clarinet sound

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Seventeen notes were played on the clarinet, each at five different sound levels corresponding to its five modes of playing. The steady state portions of the recorded 85 sounds were analysed. Sounds with most salient features were analysed using the Short-Time Fourier Transform (STFT). A specific algorithm was used to derive a set of parameters characterising the harmonic structure of each sound from the STFT. A quantitative analysis of harmonic structures of all sounds was performed. It revealed some effects of sound level on that structure.

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Measurement of vibration in a model of the soundboard of Viola Organista instrument with Laser Vibrometer

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Twenty four points were precisely spread over the soundboard of a model of Viola Organista instrument. The measurement was based on three realizations, each related to the specific construction of a particular component of the soundboard. The sounds were generated by three strings tuned in quint, mounted on the bridge, which sticked to the soundboard. Each string was stimulated by a cello bow three times in the same time period for every recorded signal. The Laser Vibrometer, calibrated to a specific range, was used to measure vibration. It was plugged into the spectrum analyser. The values of signal energy were obtained from analyser output, after appropriate processing. The maps of energy of signal vibration were obtained with the use of soundboard geometry.

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Cumulative method of the image reconstruction in synthetic aperture. Experimental results

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An analytical model of imaging using synthetic aperture (SA) methods is presented. This model takes into account: fundamental features of an environment, of an electric transmission/reception path and a description of SA structure – possible schemes of transmission, reception and image formation. Then two schemes are analyzed: a proposed cumulative synthetic transmit aperture (CSTA) and for comparison of the standard STA schemes. For both methods identical basic parameters – equal sequences of transmit and receive transducers were applied. The distinctive feature of CSTA is gathering (summing up) echoes of subsequent transmissions in one acquisition matrix sufficient for image reconstruction. In traditionally applied STA methods a separate acquisition matrix for each transmission is created. Therefore there are a dozen to several dozen more matrices and the time of image reconstruction is at least several times longer than in CSTA. The presented experimental results ob tained using wire and tissue mimicking phantoms have shown the comparable imaging quality in both methods.

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The relationship between the subjective and objective measurement of sound intensity leveling between the violin strings

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The sound intensity leveling between the violin strings is an important property of this instrument. This property is evaluated during the violin making competitions because this parameter has high influence on a playing technique. This paper presents the relationship between the objective parameters which describe the sound intensity leveling and the evaluation made by jurors of the 10th International Henryk Wieniawski Violin Making Competition. The parametrization of sound intensity leveling was realized with using the method based on searching for low energy modes below 198 Hz in the recordings of violin sounds. The arithmetic mean of the modules of differences of the sound intensity between the violin strings: G-D, D-A and A-E was used as the main objective parameter describing the violin strings leveling. The mentioned arithmetic mean was compared with the evaluations made by the jurors of the violin making competition. In this research the AMATI multimedia database was used.

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The analysis of the objective possibility of reconstruction of the baroque violin timbre aesthetics

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At present, the Baroque music is becoming more and more popular. A historical performance of Baroque music is also a subject of interdisciplinary research and the need of making the good replicas of historical music instruments is still growing. But in this case, the main problem is the inability to direct research of original musical instruments sound. The reason for this are the changes in material structure related to aging of wood. Thus, the sound of the preserved historical bow instruments is different from the original state. The developing of method to recreate the original sound of historical violins is very important.

During the work we plan to use the results of latest researches related to the automatic evaluation of the quality of sound of musical instruments and develop new classifiers of this kind.

We want to achieve this aim by using information technology, especially MIR (Music Information Retrieval). It is also needed to make interdisciplinary studies on acoustics, psychoacoustics and Baroque music aesthetics. The results of mentioned researches will be used to develop methods to build excellent replicas of baroque violin and write a computer application to support the violin makers.

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Uncertainty assessment for airborn sound reduction index measuremets with reduced size of the sample

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The problems with reproducibility of sound reduction index measurement results, not only for inter-laboratory research but also in the same laboratory, evidence of the occurrence of some factors that increase measurement uncertainty. The origins might lie in the inhomogenities of the acoustic field in the both rooms and reverberation time in the receiving room. Further factors include the flanking transmission, the background noise, especially at high values of insulation, the way of mounting the samples within the window and the reduced dimensions of the window as well a proper sample sealing. Using the propagation uncertainty law, uncertainty analysis of partial above mentioned factors have been made as well their impact on the expanded uncertainty in 1/3 octave bands and sound reduction index Rw. The analysis indicates the most influential factors on the final accuracy of measurements, including the impact of deviations from ISO standards, especially the reduced size of the sample and increased the reverberation time.

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Methods of cognitive categorization for analysis of pathological speech

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The presented article discusses the results of studies aimed at an attempt to systematize the methods used in construction of intelligent systems for medical diagnosis, based on the analysis of acoustic speech signal. New, original acoustic speech signal parameters have been proposed (called relative power coefficients), which introduce additional information concerning the changes of the voice channel parameters (treated as a sound source), and manifested by deformations of the speech signal. A new, original approach has been presented, based on the concept of automatic understanding. In general the understanding is distinguished from recognition by the fact that it is strongly knowledge based. In the meaning considered here the term"automatic understanding" denotes such an analysis of the deformed speech signal, which is oriented towards revealing the origins of the observed signal deformations. The practical importance of the cognitive methodology proposed in the paper follows from the growing importance of correct diagnosis for a wide variety of pathologies, manifesting by improper structure of the speech signal produced by the examined patient. In principle the problem is mainly of medical nature, but it seems also plausible to have in mind its social aspects.

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A self-organizing map in supporting air traffic noise monitoring systems

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Acoustic phenomena generated by various systems (biological, technical, related to environment, etc.) can be relatively precisely recorded and investigated by extracting acoustic parameters. However, at attempts of practical applications a large number of difficulties – related to the interpretation of recorded data according to the practical needs – arise. Tasks of analysis and recognition of sound signals, which – as a residual process – are emitted by technical objects are very difficult. Standard methods of processing and classification of acoustic signals applied in diagnostics are disappointing in all problems, in which we have to assess the noise arduousness, not the noise itself. Application of an artificial intelligence can be included in those information methods, which are able to combine the possibilities of the traditional acoustic measurements technique with the requirements of modern monitoring systems of air noises. The concept of the application of advance d methods of artificial intelligence as analytical tools at monitoring air traffic noises – is presented in the hereby paper.

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Efficient phantom source widening

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A suitably controlled pair of loudspeakers symmetrically arranged with regard to the listener allows to create an auditory event of adjustable width. This auditory event, the so-called phantom source, is usually narrowest when both loudspeakers are driven with the same signal. It is generally known that the phantom source can be adjusted to a variable direction in between the loudspeakers by controlling broadband time-delay and/or level differences of the loudspeaker signals. Moreover, the literature about (pseudo-)stereophony describes that nonuniform level differences or time-delay differences over frequency are suitable to widen the phantom source. A recently presented time-delay based method seems to be efficient, but seems to be restricted to the central listening spot. This contribution investigates an alternative comb filter structure that creates pure level differences instead and compares the time-delay and level-difference based approaches on central and shifted listening positions based on the interaural cross correlation coefficient and third-octave levels to assess coloration.

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