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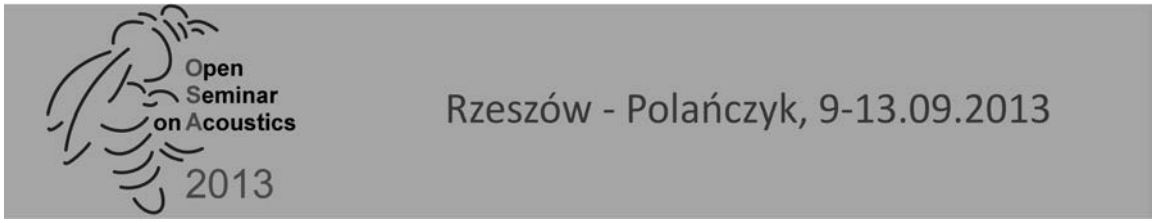

Abstracts

Assessment of the accuracy of the identification process of the sound source at the given level of the acoustic background

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The problem of assessments of uncertainty of the identification process of the sound source responsible for environment acoustic hazards, essential in acoustic measurements, is investigated in the paper.

Realisation of this task (determining likelihood of the result obtained in the control process) requires the determination of the density probability distribution function of the analysed source noise level Lsour. Its knowledge is the basic dependence needed for the estimation – with the required confidence level – of the interval of the possible assessment error of the noise level related to the controlled emission source. Its form can be derived from the identification equation, by the method of propagation of the measured variables distribution, it means: LM – the sound level of the controlled noise (under conditions of the analysed source emission) and Lbg the acoustic background level. The determination of the density probability distribution function of the identified noise level of the source Lsour, at the assumption that the measured values distribution is known, is discussed in the paper.

The derivation path of the density probability distribution function of variable Lsour, taking into consideration the lack of independence of variables LM and Lbg, is presented. The proposed solution was illustrated by examples of calculations the density probability distribution function of variable Lsour.

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Comparison of uncertainty determination methods of environmental noise threat assessment

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The theme of the work is the problem of assessing the uncertainty of controlled noise indicators. Analysis of uncertainty estimation obtained using two models formalisms was presented. The first is based on the law of propagation of distribution density functions of measurement variables used to determine the distribution of controlled noise indicator. The second solution is based on the formalism of Reductive Interval Arithmetic. Assessment of the results effectiveness of these solutions was realized and reference is made to the results obtained by Monte Carlo method.

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Stability condition for active noise control using modified FX-LMS algorithm

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Recent discoveries allow to prove the LMS algorithm stability necessary condition for very wide group of signals. The upper bound given by the stability condition, in turn, allows to choose step sizes in the manner that gives very fast adaptation at the beginning of LMS algorithm operation, or after substantial changes are detected. However, the new condition cannot be applied for the FX-LMS algorithm, where the influence of the secondary path dynamic sand its estimate should be considered. The Modified FX-LMS algorithm and structure are a concept

that allows to remove the influence of the secondary path from the error signal. Thus, the new LMS stability condition can be directly applied to the Modified FX-LMS, as long as an estimate of the secondary path is accurate enough. This paper shows the derivation of the modified FX-LMS algorithm stability condition and describes the effect of the secondary path estimation error on the step size upper bound given by the stability necessary condition. Simulations are shown for different types of signals to support the conclusion.

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The system for marking and identification of the spots dangerous and of special importance for vision impaired persons in the big city – information given by vibrating bracelet

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Paper presents progress and results of psychophysical studies connected with vibration perception on the wrist of blind people. Studies were carried out under the research project entitled The development of the method for marking and identification of the spots dangerous and of special importance for vision impaired persons in the big city with use of the wave-vibration markers. Six situation which require marking were selected based on previously conducted survey. The aim of psychophysical studies was to select vibration signals which could give blind people information about zone in which they are.

It was assumed that signals should be easy, but also should enable to give six, different information. It was decided to divide test into two stages. In both stages signals were evaluated using short, 5-point, numerical and verbal ICBEN scale.

In first task, signals were presented singly to evaluate their annoyance and ease to learn and memorize After this task six signals which received the best scores was selected. In second task, signals connected into pairs were presented to evaluate their recognizability. Results of first and second task were compared and signals which were to similar were deleted from chosen six. Finally, six signals were selected and matched with following situation: staircases with differentiation of direction, rail platform, tram platform, pedestrian crossing, temporary obstacles: excavations, road works, temporary bridges and public buildings.

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Vibrational energy transfer in a welded joint model with shell elements

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The work presents the concept of research methods in vibrational energy transfer with application to analysis of dynamics of structures that use energy of mechanical vibration as an evaluation parameter or other items related to energy. The structural surface intensity representing time-averaged flow rate of the mechanical vibration energy by unit area perpendicular to the flow direction was used in studies of the specific vibration energy flow in solids. Analysis of the spatial distribution of structural intensity allows the study of vibrational energy transfer paths and places where energy is introduced or absorbed in the mechanical structure.

The purpose of work was the research vibrational energy pathways in the flat components of welded structures including different FE models of connections. The analysis was performed for a particular model of the welded plates connected at an angle of 90° and two strips placed on the plates. Such flat welded components are widely used in the construction of buildings and vehicles.

The modeling studies were preceded by a detailed review of literature in the area of computational methods used in the analysis of welded joints in particular using the finite element method. Special attention was paid to the methods of vibration energy flow analysis using structural intensity for flat plates. Computational methods applied for the study of vibration energy pathways in the structures of complex shapes, made of flat thin items such as plates and shells so far were insufficient to solve the problem of modeling of welded joints. In the analysis of specific practical cases the problems appeared to take into account a complex boundary conditions, properties of structures and the selection of a particular type of finite element model for the analysis of vibration energy flow in the welded joints.

The major problems affecting the quality of welded joints come from the thermal energy dissipation during the merge process, which changes the structure of the welded material and causes the heterogeneity of the material structure. This results in the change of mechanical properties of the joints, stress concentration, formation of residual stresses and strains in the welds and adjacent areas. Modeling of welded joints in computational finite element analysis (FEA), particularly modeling and analysis of T-joints is a complex problem and difficult for accurate representation. Requires a special approach in selecting the model taking into account the complexity of the structure – its geometry and mechanical properties. There are commonly used simplified models of fillet welds using shell elements of increased thickness, rigid finite elements and solid elements. The best results were obtained for the calculations with use of oblique shell elements, simulating in the correct way connection of elements and bending stresses in the weld area.

There are given results done with the new approach of modeling for angled welded connections of plates. The results were compared with earlier results of modeling done by the authors. The calculation results showed a significant increase of the modeling accuracy of the vibrational energy flow in welded joints.

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Influence of the bit rate in MP3 compression on the speech quality

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Over the last years, there has been a significant development of telecommunication technologies, inter alia, in video as well as speech signal transmission. As a consequence new, more effective methods of utilization of transmission bandwidth are required. Nowadays there are multiple, different solutions in use, in which the speech signal is being transformed for more efficient transporting, storing and recognition. There are many algorithms for coding the audio signals. In this article the impact of bit rate on the quality of speech signal transmission encoded as MP3 is researched. The described measurements were done for bit rates in range between 8 kbps and 320 kbps, using two subjective methods recommended by International Telecommunication Union (ITU) – namely Absolute Category Rating and Degradation Category Rating. The assessment of the speech quality was done using the sentence lists read by a female and male lector.

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Influence of the plaster physical structure on its acoustic properties

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This work presents the main experimental results obtained from the study of plaster test pieces with different parameters of its physical structure. Mainly an aeration of plaster and amount and diameter of the pearlite in it, expressed in per cent, are considered as parameters. Other parameters are also studied, but they play a minor part, for example the different thickness of the sample. Acoustic properties, measured via the sound absorption coefficient, are researched depending on the proportions of the aeration and/or the pearlite. The results are compared to the absorption coefficients of the conventional plasters. The physical, mechanical and thermal properties are not analyzed. The results show that an improvement in the absorption coefficient is obtained. This coefficient increases with the increase of aeration and appropriate diameter and proportion of the pearlite. This is due to the increase of the open porosity.

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Acoustic interaction of orchestra pit with the audience and the stage in the example of the opera house in Lviv

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The article raises an important issue that occurs in multipurpose room equipped with orchestra pit. Placing an orchestra at a lower level relative to the stage and the audience allows to hide it from the sight of the audience, but also reduces the direct sound propagation path. It causes the need to maintain an appropriate acoustic interaction between the orchestra pit, stage and the audience. The paper presents the results of acoustic surveys and simulation calculations performed in the hall of the Opera House in Lviv which enabled the analysis of this phenomenon. The study investigated the impact of the depth of the orchestra pit, the height of the railings, the geometry of the selected reflection planes and acoustic adaptation of the orchestra pit. The goal of the study was to link the commonly known room acoustic parameters, such as G, C80 with the evaluation of the interaction of acoustic orchestra pit, stage and audience.

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Optimization of multi-channel sound field synthesis systems in open space

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The paper presents the optimization of the parameters of multi-channel sound field synthesis systems located in truncated area of open space. The work is divided into three main stages: modelling, simulation and analysis, and optimization. The first of these include the building of above-mentioned sixteen-channel sound system models using FEA implemented in ANSYS. The input parameters have been defined as sound power attenuation levels and delays for each pair of sources located symmetrically along interior area. Next the simulation and analysis of five system cases were performed. The numerical experiment has been designed with the use of hybrid experiment plan – a combination of central composite and optimal space filling design. Attenuation levels were changed in the range of 0 to 20 dB and delays from 0 to 4 ms. The final stage of the research was carried out for the optimization of different system variants using the screening method and the method based on evolutionary algorithm NSGA-II. The studies have shown that in the multi-channel sound system the modification of sound sources attenuations and delays can improve sound field parameters determined at selected points in the interior area and reduce the sound pressure level in the exterior region.

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Modelling of wind turbine acoustic emission

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In last years wind turbine noise problem is becoming much more urgent. The issue is studied in years. There are many studies of various aspects of generating, modeling and protection against this type of noise. Many of the existing models assumes that a wind turbine is a point source. One of the arguments for this approach is the small dimension of the source in relation to the measurement distance. Authors present a method of modeling the aerodynamic noise source, which is a wind turbine. This model has many weaknesses, but allows for an approximate determination of the directional pattern of such source. With the inclusion of the directional pattern, it is possible to use a point source model.

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The influence of classical guitars' physical properties on the subjective assessment of their tonal quality

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One of the main goals in musical acoustics research is to link measurable, physical properties of a musical instrument with subjective assessments of its tone quality. The aim of the research discussed in this paper was to observe the sound pressure response and structural vibrations of different class classical (nylon-stringed) guitars in relation to their tonal character and quality.

Twenty seven classical guitars of different price range have been investigated – both manufacture (18) and handmade (9) instruments. Measurement methods of determining sound pressure and body vibrational responses are presented. Structural modes of top and back plates have been measured with the aid of a scanning laser vibrometer. Additionally, sound pressure response measurements were performed in the anechoic chamber. The instruments were excited with a modal hammer or a bone vibrator. The tonal quality and characteristics of the instrument was determined based on the results of subjective assessment listening tests performed on a group of experts. The list of carefully selected subjective parameters, which represent the unique and characteristic features of classical guitars' sound quality, has been introduced. Based on correlation and descriptive statistics, the relation between established objective and subjective classical guitar parameters has been investigated and discussed.

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The propagation of acoustic waves in an inhomogeneous medium

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The aim of the paper is to present the analysis of the problems the propagation of acoustic waves in an inhomogeneous medium. A suspension of dust in the air and gas bubbles in the liquid are examples of so-called grained medium. The presence of inclusions has an influence on the propagation of acoustic waves in the medium, changes since the average density and compressibility of the medium and occurs scattering of waves. In the presence of suspended solids or liquids in liquids resultant of velocity of the wave in the medium grained calculated based on considerations for the mixture. When the gas bubbles are in the liquid, changing the volume fraction of the system. Inclusions vibrate under the influence of the acoustic wave modifying it in volume.

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Application of shape memory elements for excitation and reduction of the vibrations of the plate systems

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From way back smart materials have had a use as technical applications in the reduction of the mechanical vibrations.The most popular materials used in this field are piezoelectric ceramics, however, they show limitations in the range of low frequencies. Materials that could fill this gap are the elements with a shape memory. Actuators made of this material generate sufficient force so as to affect the systems' movement even in very low frequencies.

This paper discusses the issue of reducing mechanical vibrations by using shape memory elements in plates with different types of fixation and means of vibration excitation. At the same time this study also presents the results of laboratory tests which are related to the analysis of the application of nitinol actuators to the reduction of the vibrations. The research was based on forcing the plate system to vibrate and providing extra energy into the system in order to control this phenomenon. The shape memory elements are meant to decrease or increase the amplitude of the vibrations in these systems.

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Residual noise in the method of measurement of nonlinear distortion with broadband noise

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In the measurement method of nonlinear distortion with broadband noise the exciting noise is filtered with a band-stop filter, which removes a narrow frequency band of signal. This signal is given to the system under test and at the output the signal is filtered with a band-pass filter tuned for the same frequency band as removed at the input. For linear systems the output signal should be equal to zero. The measured signal is the product of nonlinear distortion. The band- pass filter at the output should have a bit narrower badwidth than the band-stop filter at the input because of finite slopes in the frequency response of both filters in their stop-bands. In the rejected frequency band the residual noise appears. Its level should be significantly lower than the expected product of nonlinearities. In the paper a method of computing of residual noise is presented. The calculation have been made for different types of filters, for different noises e.g. white or pink and different bandwidths of analysis.

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Pyłofon – strong acoustic wave generator for surface cleaning of heat exchangers in power facilities

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Gradually increasing ash layers on the heating surfaces reduce the transfer of energy to the heating medium and restrict the free flow of gas in the spaces of power boilers built. Especially, it concerns the coal-fired boilers. This results in energy loss due to the increase in exhaust gas temperature. Another adverse effect of ash pollution is the need for frequent exemptions from the operation of boilers to clean heating surfaces. Therefore, it is necessary to use effective methods of cleaning the heat exchange surfaces during operation of the boilers.

The paper presents the acoustic method of removing ash layers using strong acoustic wave generated by pylofon. This method is based on the stimulation of gaseous medium oscillation, in this case the exhaust stream, with a strong acoustic wave. Exhaust reach all the boiler, which allows to propagate the acoustic wave to inaccessible areas if another method was used such as blowing ash by steam or compressed air. The device, which fully exploits the potential of this acoustic method is pylofon, which generates a strong acoustic standing wave, aimed at vulnerable to pollution boiler area. Pylofon control system allows to keep the generator in operation despite changing thermal conditions during the operation of the boiler. The typical applications of pylofons are water and steam power boilers of different capacity and desulphurisation reactors or catalysts in systems reducing emission of NOx.

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The sensitivity analysis of multi-channel sound field synthesis systems in the open space

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This paper presents the results of a sensitivity analysis of multi-channel sound field synthesis systems in the open space.

The study was conducted for sixteen-channel sound control system in which local and global sensitivity of parameters inside and outside selected areas were determined. Changeable input parameters of the system were sound power attenuation levels of individual sound sources and additional delay. The output parameters were observed for the one-third octave center frequencies in the range of 62.5 to 250 Hz. The studies concerned parameter selection in such a way as to obtain at least desirable minimum SPL and the highest SPL uniformity in 15 points within the area. The second equivalent goal was the lowest possible level of the average SPL outside the listening area. To perform properly planned analysis the design of experiment method was used. It combined optimal space filling and central composite designs. The experiment was carried out on the basis of a model builded by applying FEM. Obtained output parameters have been interpolated by Kriging's algorithm and formed system meta-model. Local sensitivities were determined at points on its response surfaces. Then, by calculation of the meta-model response in 2000 pseudo-random points, Spearman's rank correlation coefficient matrix and on its basis global system sensitivities have been determined.

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The negative aspects of automation of selected acoustic measurements performed in an anechoic chamber

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Automation of vibroacoustic measurements is an inevitable process because of the modern requirements according to precision of a microphone positioning and the number of measurements points, that are necessary to obtain specified parameter with required accuracy. Apart from undoubted advantages of automation, every additional device in the anechoic chamber, can disturb the free field there, and should be thoroughly analyzed before and after application.

In the paper, the problem of measurements errors generated in some studies performed in the anechoic chamber using mechatronic manipulator is presented. In order to determine negative impact of positioning devices on measurements results, sound diffusion coefficient, directional characteristics of sound source and sound power level measurements were analyzed.

Basing on the results of the study, some areas of anechoic chamber were selected, where hardware of the manipulator could influence the results of measurements made there. Moreover, different constructions of the manipulators were considered and some solutions were proposed, that allow to limit the negative impact on described measurements.

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Modal analysis of the cylindrical waveguide acoustic field, possible sources of error and its effect on consistency with the theoretical model

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The presented studies of the acoustic field inside cylindrical waveguide were aimed at qualitative and quantitative determination of its modal structure and verification of consistency of the obtained measurement results with theoretical assumptions of the hard-walled semi-infinite cylindrical waveguide model by means of solving the corresponding inverse problem. Solution of the inverse problem, i.e. determination of amplitudes of individual modes, was based on acoustic pressure distribution measurements taken on selected cross-sections of a cylindrical waveguide excited by means of a single-tone sound source located inside the system either axisymmetrically or not. Frequencies of signal applied to the source were selected in such a way that they fell between consecutive radial/circumferential mode cut-off frequencies so apart from the plane wave, also consecutive higher wave modes could be observed with the increasing excitation frequency. The analysis included acoustic field distributions inside waveguides corresponding to mathematical models of the infinite cylindrical waveguide and the semi-infinite unbaffled cylindrical waveguide, i.e. with the diffraction phenomena occurring at the open waveguide outlet taken into account in the latter case. The paper is concluded with analysis of consistency of the obtained measurement results with predictions of the theoretical model and the effect of most likely error sources of the overall error of the measurement method.

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Application of artificial neural networks for the diagnosis of arterio-venous fistula on the basis of the acoustic signal

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In this work a new diagnostic method of arterio-venous fistula is presented. Fistula is surgically made connection between artery and vein to obtain access to subcutaneous venous vessel with high blood flow, which is essential for hemodialysis. Depending on the patient's health, the fistula is a source of various sounds. Every dysfunction may lead to thrombosis or another complication which is dangerous for life or health. Analysis of sounds generated by the blood flow through the fistula allows to detect the pathological conditions. Signal from fistula is analyzed with the use the open source library called FANN (Fast Artificial Neural Network). This solution is applied in the commercial telediagnostic system, which provides remotely tests by cellular phone.

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Bayes networks used in application to pathological speech diagnostics

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Bayesian Networks (BN) are one of the methods allowing formalization of process dynamics as a predictive model. They have been created about 35 years ago, and their main features are ability to show the cause-and-effect relationships, picture uncertainty as the probability distribution of variables. And also ability to compute calculations with incomplete data. Bayesian Networks were designed to induce in static situations and their direct use in evolving problems is difficult. The solution of this problem turned out to be the Dynamic Bayesian Networks, which are extended version of Bayesian Network, enhanced with stochastic representation of processes changing over time.

The Dynamic Bayesian Networks (DBN) are powerful and elastic tool that can be used to represent probabilistic models for stochastic processes. There is growing interest in application of this tool to solve practical problems, including processing and

recognition of speech signal elements. Process of evaluation of pathological speech acoustic signal deformation is a matter of assignment the acoustic images, obtained from research, to certain classes. However, in opposition to other tasks, mentioned collection of classes is usually unknown earlier. It causes restricted application of classic classification methods in pathological speech analysis.

The purpose of presented paper is an attempt to use DBN to automatically find mappings, connecting collectivity of acoustic signal samples (for example, corresponding to correct and incorrect states of biological systems), with adequate indicators having practical diagnostical use.

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Acoustic properties of biocompatible magnetic nanoparticle water suspensions

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Magnetic nanoparticles have been most studied and have a vast potential for application in many different areas of biomedicine, from diagnostics to treatment of diseases. For medical applications nanoparticles require highly biocompatible particle surfaces. Biogenic magnetoparticles such as bacterial magnetosome particles, derived from various magnetotactic bacteria such as Magnetospirillummagnetotacticum are organelles consisting of magnetite crystals enclosed by a phospholipid membrane that offers a high degree of biocompatibility. For chemically obtained particles chemical modification of the nanoparticles surface is necessary. Many synthetic and natural polymers such as dextran or PEG are biocompatible and may be used as coatings.

Ultrasound spectroscopy is very useful in the investigation of nanoparticle suspensions (in a wide range of their concentrations and with particles of a wide range of sizes) and has advantages over many existing technologies because it is non-destructive and non-invasive, and can rapidly measure and be used to characterize systems which are optically opaque (the measurements can provide useful information up to higher concentration than optical methods). The acoustic properties of suspensions, such as velocity and attenuation of ultrasonic waves, have been measured. The method is used for determination of the hydrodynamic particle size distribution, the elastic properties, and aggregation processes under the influence of magnetic field.

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The effects of infrasound on the levels on activation

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The paper summarises the research data showing how low frequency sound affects the level of activation in humans. Activation levels were measured with the use of the self-assessment questionnaire, known as the Activation-Deactivation Adjective Check List (AD ACL). The research program involved three independent stages. The acoustic stimulus applied in the first stage had frequency f=13 Hz, sound pressure level SPL= 105 dB (HP). The exposure time in experiment was constant (20 min). Results indicate a statistically significant decrease of the General Activation effect following the low-frequency sound exposure.

This study is a part of the N N501 247740 research project, supported by the National Science Centre.

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Identification of aircraft noise during acoustic monitoring by using 3D sound probe

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Undertaking long-term acoustic measurements on sites located near an air-port is related to a problem of large quantities of recorded data, which very often represents information not related to flight operations. In such areas, usually defined as zone of limited use, often other sources of noise exist, such as roads or railway lines treated is such context as acoustic background. Manual verification of such recorded data is a costly and time-consuming process. Automatic differentiation of the tested noise source from background and precise recognition the quantitative impact of aircraft noise on the acoustic climate in a particular area is an important task. This paper presents concepts of method for identifying aircraft operations (flights, take-offs, landing), supported by experimental studies, using 3D Microflown sound intensity probe and ambisonics microphone Soundfield ST350. The proposed method is based on determining spatial sound intensity vector in tested acoustic field during the monitoring timespan. On this basis aircraft opera-tions are marked in a continuous record of noise events.

The paper has been written and the respective research undertaken within the project 2011/01/D/ST6/07178 (National Science Centre).

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Determination of acoustic parameters of REPOWER MM92 wind turbine for changing operating conditions

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In Poland, one of the most popular sources of renewable energy are wind turbines and all are onshore ones (i.e., located inland), and often are in close proximity to inhabited areas. Their operation raises issues as to environmental and health impact, in the context balancing strict standards in granting environmental permits for new wind farms and supporting renewable energy production nationwide. There has been a number of publications in Poland and worldwide concerning environmental and health impact of wind turbines operation on nearby residents and natural habitats, but these quite often came to contradictory conclusions. This article presents the results of research performed in order to determine the impact of changing operating conditions of a wind turbine caused by different weather conditions on the measured acoustic parameters (LAW – A-weighted sound power level, L_{Aeq} – A-weighted sound pressure level). Determination of acoustic impact of wind turbines has merits when it reaches its nominal operating conditions, and then its limits. That happens for wind speed for $v = 10$ to 25 m/s at the height of the nacelle (for example 100 m), which often translates to (depending on the stability of the atmosphere) for the wind speed at the height of the receiver (for example: 1.5 m, 4 m or 10 m) to a value $v > 5$ m/s. In this case, the standard microphone's windcscreen do not seem to cover the job. This paper presents the results of measurements taken for different wind speed.

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Acoustic barriers in landscape

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In the recent years significant increase of environment noise pollution, mainly in the industrial areas, has been noticed. It is caused by the functioning of industrial objects and intensity of motor, railway and air traffic.

Currently the majority of operations yield to eliminate environment noise pollution by assembling following acoustic barriers, which due to their sizes and colouring, may be found awkward in the light of the landscape composition.

During the assembling process the sustainable development is omitted causing sharing the public space with vertical barriers resembling isolated ghettos in which ordinary inhabitants are supposed to dwell.

In the article problems associated with acoustic barriers' effectiveness, the way they are arranged in the public areas, esthetics and landscape composition were discussed.

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The noise reduction studies of the "bionic" fan

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To minimize the noise emission is an important issue to be considered in the design of future of the airfoils. Solutions of the noise problems are also looking for in nature, especially in owl's. Their silent flight is possible thanks to the special structure of their feathers. Their secondary flight feathers are cut in the shape of the teeth at the leading edges and the combs of the trailing edges. The effects of noise reducing by cutting the regular teeth of the trailing edge of profiles were been studied in literature. The results depend on the size of the teeth, the width between the top of the teeth, angle of attack blade, Reynolds number, etc. In our work concern on the serrated trailing edge of the axial fan's blade. We studied the noise of fan with isosceles teeth on trailing edge of blades. The efficiency and flow rate were better for the bionic fan than the orginal. But the acoustic parameters were not good. But there were some evidences (e.g. decrease of the SPL in FFT analysis) that the teeth on the trailing edge of blade may be desirable.

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Influence of air inlets on window sound insulation depending on mounting location

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Use of air inlets, which is sometimes a necessity, significantly decreases window sound insulation. Several methods of improving the sound insulation of window systems with air inlets are proposed to maintain acoustic comfort in rooms. Results of sound insulation test of windows with air inlets, mounted in three different installation systems, have been described and discussed in this article.

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Active noise and vibration control of circular plate with the use of MFC actuators

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An active vibration control system is proposed for suppressing small amplitude harmonic vibrations of a thin circular plate and related problem of reducing structure-borne noise. This system integrates control algorithm, intelligent materials, as well as hardware and software technologies based on LabView and NI CompactRIO platform. The PSV-400 Vibrometer was used to find the optimal sensors location and the plate resonance frequencies. The primary excitation is provided by a rectangular MFC actuator bonded to the plate, while a star shape MFC element located in the middle of the plate is used as the secondary actuator. For the considered system, the ARX method of discrete-time model identification for real-time active vibration control has been applied. On the basis of this model, the control algorithm based on pole-placement method has been developed. The simulation results show that the designed structure of a close-loop system with MFC actuators provides substantial vibration suppression.

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Index assessment of noise hazard of work environment in opencast mines of rock material

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Proposals for noise hazard assessment of work environment in opencast mines of rock material by means of partial and global indices were shown in the paper. The single-number global index of assessment is a function of four partial indices: the noise hazard assessment at workstation index, the impulse noise index, the continuous noise index and the sound power of machine index. Calculation procedures of indices were given in the paper.

Verification of partial indices was performed on the basis of data obtained from preliminary acoustic investigations carried out in the andesite and the limestone mines. Verification of the proposed global index demands continuation of research and analysis based on the complex acoustic measurements in opencast mine of rock material, in which the acoustic climate is assessed.

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Acoustic waves in the sea

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The propagation of acoustic waves in the sea offer a number of possibilities for practical application. This paper will discuss the propogation of acoustic waves in shallow seas while naturaly taking into account factors which influence boundary conditions on the surface (air and sea water). In particular, the main factors that affect the climate of underwater acoustics will be considered, with a particular emphasis on underwater noise produced

by the movement of ships. In this respect, the mechanism of the radiation of acoustic waves by a propeller is discussed as one of the most intense sources of underwater noise generated by ships and other vessels moving in the water.

Another issue that will be presented in this paper is the use of developments in underwater aquatics, and in particular non-linear acoustics, to study the structure of the seabed.

Parametric sonar, as the main practical product of nonlinear interaction of large amplitude elastic waves, is one of the most attractive tools for remote sensing studies.

The above issues will be illustrated by the results obtained from investigative research experience.

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Active noise control using TMS320C6747 processor

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In this paper an early stage of the design of active noise control system based on the TMS320C6747 is presented. Aim of the article is to introduce capabilities of the system and its limitations. Purpose of the system are in-situ situations, where the system can applied immediately without measurements and system/signal analysis using PC and special software. Results of example laboratory tests using genetic algorithm and neural network are presented.

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Numerical study of acoustic-structure interaction of selected helicoidal resonator with flexible helicoidal profile

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The paper presents the results of numerical studies of acoustic-structure interaction of selected helicoidal resonator with helicoidal profile made of an elastic material. Considered a well-recognized acoustic system for one representative type of acoustic helicoidal resonator with two resonant frequencies that correspond to previous studies of the author. Due to the large range of flexible materials to study, this work focuses on the change of material density, Poisson's ratio and Young's modulus as the basic parameters describing the properties of elastic materials. The results indicate a significant interaction between the acoustic attenuation performance of helicoidal resonator and elasticity of the helicoidal profile. These interactions are most evident in the frequency range in which the helicoidal resonator is revealed to be effective acoustic damper.

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Rotating helicoidal resonators – pilot study

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This paper focuses on identifying the possibility of rotation of helicoidal resonators under the influence of the air flow in duct and its acoustic and flow consequences. In order to carry out research there were made a special part of the test bench (transition), so that it was possible to rotate the helicoidal resonators placed in section of the cylindrical duct with a length of approximately 0.5 m in axis. The transition element, length of 80 cm, has a larger diameter than the inner section of the duct with the resonator (140 mm/125 mm), but the other part of the test bench is made of cylindrical ducts with a diameter of 125 mm. There were measured rotational speed of bearing-supported half a meter of cylindrical duct with helicoidal resonators inside, depending on the flow velocity. Pilot studies suggest an interesting possibilities of additional use of helicoidal resonators, as silencer and energy recuperator.

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The study of pressure drop depending on the air flow rate in duct of selected helicoidal resonators

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The paper presents the measurements of pressure drop for selected three helicoidal resonators depending on the volume air flow in the cylindrical duct with a diameter of 125 mm. There were considered three helicoidal resonators with constant ratio $s/d = 1.976$, but different number of helical turns n. The first two types of resonators do not differ significantly in terms of the number of turns, $n = 0.671$ and $n = 0.695$, but this small change in spread of helicoidal profile reflects a large difference in acoustics, two resonances and one resonance, respectively. The third selected resonator has the same ratio of helical slope s to duct diameter d, s/d, but the number of turns is $n = 1.0$. It is one of the characteristics of acoustic resonance of symmetrical distribution of attenuation of sound in relation to the center frequency. The study was performed at the newly built experimental set-up for testing silencers, determining flow noise and total pressure drop.

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Infrasound acoustics field analysis using beamforming method – a study on infrasound sensors

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To study infrasound acoustic field one should first develop an infrasound acquisition and measuring system. A high price of infrasound measurement reference microphones is an effective barrier from large-scale use of them. On the other hand the characteristics of the standard acoustic microphones are measured for audible range only. That doesn't mean that these microphones can't be used for infrasound studies. A small mechanical and electric circuit modification allow standard microphones to have a satisfactory effectiveness for infrasound spectrum.

After these modification an infrasound measurement reference microphone should be used to obtain the characteristics of modified standard microphones by means of comparative method. Such measurement should also help in designing a filter to compensate the possible nonlinearities in modified frequency characteristic.

This work shows a concept of an infrasound acoustic field measuring system and studies on a microphone for measuring infrasound.

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Modeling and designing of ultrasonic welding systems

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This article presents the main stages and the main challenges in modeling and designing of modern ultrasonic welding and cutting systems. First, the key components of such a system, such as an ultrasonic stack (consisting of a high power ultrasonic transducer and a sonotrode) and a digitally controlled ultrasonic power supply with precise control of the output power have been considered. Next, a concept of measurement system for verification and validation of mathematical models of ultrasonic stacks and its components has been presented. Finally, a method of ultrasonic stack e-diagnosis based on ultrasonic transducer electrical impedance measurement during welding and cutting process has been described.

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The influence of room and directivity of source on the subjective evaluation of sound

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The aim of this study was to determine the influence of the type of room and directivity of source on subjective evaluation of sound. Investigations were conducted using a computer simulation technique. For three rooms, varying significantly in size and shape, impulse responses were simulated using three different sound sources – two of them corresponded to the actual loudspeaker systems and the third – an idealized source with omnidirectional characteristic. Due to the convolution operation with audio signals, which were two fragments of speech and two fragments of music, 36 test signals were obtained. Subjective study, which was attended by five normally hearing listeners, were carried out using headphones. Test signals were grouping into triads and the listeners' task was to determine a pair of the most similar sounds and a pair of the least similar sounds in every triad. The analysis of the results was performed using the method of multidimensional scaling (INDSCAL). In the second stage a parametric evaluation was performed. It consisted in determining the intensity of a given attribute of the perception space in the global acoustic sensation. Using the correlation analysis it was possible to relate a particular dimension of the multidimensional space to the attributes of the perception space.

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An adaptive vibroacoustic control system with multiple independent feedback loops

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An active control system for reduction of vibroacoustic emission of plate structures with arbitrary boundary conditions is presented. The system uses small, rectangle-shaped piezoelectric transducers attached to the surfaces of the controlled structures acting as both sensors and actuators. The paper consists of three parts. The first part describes the developed and implemented algorithms for determining acoustic radiation characteristics and the optimal control parameters. The acoustic pressure distribution in the space surrounding the considered vibrating structure is computed for the free-field case using the Indirect Variational Boundary Element Method and the elaborated computational scheme. The developed optimal control algorithm is self-adjustable and has a capability of estimating modal components of the external excitation force with unknown spatial distribution basing only on the signal from piezosensors. The aim of the control is to minimize the amplitude of the acoustic pressure in a specified point of the surrounding space. In the second part the developed numerical models and the results of the simulations are described. The third part presents the physical implementation of the designed control system and the experiments performed in an anechoic chamber. Acoustic radiation characteristics of the considered structures and the control performance of the developed system are investigated and the results are compared to the results of the simulations.

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The new series of standards for the measurement of sound insulation in buildings

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In the near future the ISO Committee will introduce new measurement standards for acoustic insulation in buildings. The ISO 16283 parts 1–3 will replace the existing series of ISO 140 Part 4, 5 and 7. ISO 16283 (all parts) describes procedures for field measurements of sound insulation in buildings. Airborne, impact and façade sound insulation are described in ISO 16283-1, ISO 16283-2 and ISO 16283-3, respectively. ISO 16283 differs from ISO 140-4, -5, and -7 in that:

- it applies to rooms in which the sound field may, or may not approximate to a diffuse field,
- it clarifies how operators can measure the sound field using a hand-held microphone or sound level meter and
- it includes additional guidance that was previously contained in ISO 140-14.

The article describes new standard and compare both methods.

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Ultrasonic projection imaging using multielement ring probe

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Ultrasonic projection imaging is similar to X-ray radiography. Nowadays, ultrasonic projection methods have been developed in the set-up of multielement flat arrays with miniature transducers, where one of the array acts as a transmitter and the other one is a receiver.

In the paper, a new method of the projection imaging using a 1024-element ultrasonic ring probe was presented. That ring probe allows for the choice of a projection scanning plane for any angle around an investigated object dipped in water. The fast measurement data acquisition is possible due to a parallel switching of opposite transmitting and receiving transducers in the ring of the probe and to a vertical movement of the probe. The algorithm equalizing the length of measurement rays and distances between them was elaborated for the reconstruction of projection images.

Projection research results of different media obtained by means of the elaborated measurement set-up and compared with

mammography simulations (acquired through the overlapping of X-ray tomographic images) show that ultrasonic projection method presented in this paper can be applied to the woman's breast providing diagnosis for an early detection of cancerous lesions and most of all, as an alternative or complementary method to mammography. Mammography is harmful because of ionizing radiation and invasive because of the mechanical compression of tissue.

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Acoustic test method of single electrostatic discharges

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Electrostatic discharge of energy exceeding the ignition point is a potential source of explosion in the case of explosive atmosphere. To eliminate such a hazard, detailed testing of the non-metallic materials as regards collection of electrostatic charge on their surfaces and possibility of the charge flow to earthed components, is indispensable. Standard methods of electric measurements of discharge have some features that are difficult to be eliminated, when the result of high accuracy are required. The option are non-electric methods of measuring the electrostatic discharge, which do not interfere with discharging circuits and enable measuring the charge of a single brush discharge transferred from the surface of electrified material.

Use of the acoustic method to measure a single discharge, the value of which is the basis for assessing the non-metallic material safety in explosive atmospheres, is described. The measurement of acoustic effect of discharge enables to parameterize the igniting properties of the material due to accurate correlation of pressure acoustic wave parameters with the value of charge moved from a surface of electrified material. The described method can be used for an individual measurement of electrostatic discharge or can be a completion to the traditional electric measurements method in the case of both of spreading brush discharge and full discharge.

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Using the information entropy method to assess the psychoacoustic emotions induced by sound sources

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This article presents a multisensory approach to sound perception for the needs of assessing the emotions induced by sound sources. A connection has been identified between shaping soundscapes and the public's subjective assessment of sounds. The concept of soundscapes constitutes a new approach to managing the tasks of shaping the acoustic environment in urban areas. In this approach, task management is not limited only to shaping the acoustic climate. The essence of the new approach consists in carrying out research to identify the public's subjective impressions in order to assess the qualities of the sounds of acoustic events in the environment. An information form of representing the stimuli and emotions has been proposed to analyse sound perception.

An example has been prepared where an attempt was made to assess the impact of the stimuli on the quality of psychoacoustic emotions induced by a selected sound source using the information entropy method. The problem discussed here is a continuation of the research on the development of a qualitative assessment model to evaluate the acoustic emission of sound sources in the environment.

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Uncertainty in sound scattering coefficient measurement

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Sound diffusion structures are characterized by two main parameters, that describe the quality of the sound reflected from them. In the case of sound scattering coefficient, which is measured in reverberation chamber according to ISO 17497-1, the standard recommend the calculation of uncertainty according to the law of propagation. Only type A evaluation basing on measurement results is presented, while for example the uncertainty connected with the measurement realization of the definition of the parameter is ignored. What is more, the standard ISO 17497-1 assume, that input values (reverberation times) are independent, hence omit the estimated covariance calculation. In the paper the calculation of uncertainty in the sound scattering coefficient s is presented. The method proposed by the standard is compared with values obtained taking into account correlation between input values and the results of the Monte Carlo method. It was shown that for some frequencies, the ISO standard uncertainty is much smaller, than calculated according to the other methods.

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Selected changes of voice properties following tonsillectomy

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Tonsillectomy is a kind of laryngological operation, which involves changes within articulatory structures of the vocal tract. Although these changes are not big in dimension, they can cause voice changes. As these changes can be important to some patients (e.g. actors or singers) they should be informed about such possible side effects during the medical interview with the laryngology surgeon before the decision concerning tonsillectomy will be made. Therefore the research into voice properties following tonsillectomy was necessary – and such a research was carried out by the authors of the presented paper. The recordings were made – before the surgery and around 6 weeks after the treatment. 20 patients (12 male and 8 female) were examined this way. In registered acoustic material especially vowels: /a/, /e/, /i/ and /u/ were taken into account.

During the analysis of this material following parameters was taken into account: first four formants amplitude and frequencies values and 20 successive mel-frequency cepstral coefficients for 300-mel wide filters. The results of the research show which voice parameters change after tonsillectomy and how voice quality can be worsened after this type of surgery. Detailed results of the research mentioned above will be presented.

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Discrimination of lossy compression in musical recordings by listeners with different auditory training

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Audibility of lossy compression produced by four lossy codecs – Vorbis, WMA, Mp3 (Fraunhofer) and Mp3 (Lame) – in samples of classical and popular music was studied on groups of naive and experienced subjects to determine how average discrimination of compressed/decompressed sound depends on auditory training, and with participation of three subjects to determine the inter-subject differences in discrimination. At the lowest bit rates of 32 and 48 kbps compressed music was easily discriminated by all listeners. Compression became inaudible at bit rates of 80–96 kbps and higher. Trained subjects demonstrated better ability to discriminate compressed music than naive subjects by about 16 kbps on the average. There was noticeable inter-subject difference in discrimination of sound after compression by various codecs. The presence of interfering noise had limited influence on discrimination even at S/N within the range of +4 to +16 dB.

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The influence of seats' sound absorption test method on prediction of acoustic parameters in auditoria and concert halls

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This paper presents the own study on sound absorption by seats used in concert halls. The absorption coefficients for seats were defined using methods described by: Beranek, Kath and Kuhl, Nishihara and also on the basis of ISO 354. Afterwards, obtained results were used in the calculation model for prediction of acoustic parameters in Philharmonic Hall in Rzeszów. The comparison of room acoustic parameters derived from the simulations and measurements enabled to identify the best method for the determination of the seats' sound absorption coefficient. Since the auditorium in concert hall is the part of the highest sound absorption, it has a decisive influence on the interior acoustic parameters. The accuracy of determination of the seats' sound absorption coefficient can also improve the prediction exactness of room acoustic parameters.

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The study of sound insulation of buildings with the use of aircraft noise and loudspeaker

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The measurement results of airborne sound insulation of building façades have been presented. Single-family buildings were examined using the global air traffic method and the global loudspeaker method. The measured sound insulation values have been analyzed in terms of their compliance with the requirements and to determine pathways of noise from the outside to the rooms. The shortcomings of current standards in terms of their upgrades were also highlighted.

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The effect of arrangement of sounds in a musical piece on perception of the tonal center

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This report constitutes a kind of résumé or synthesis of certain issues raised by the authors in their earlier conference contributions, especially those presented at the 59th Open Seminar on Acoustic (2012) and 20th Conference on Acoustic and Biomedical Engineering held in Zakopane this year. These problems are related mainly to the issue of perception of composite sounds used in music, in particular composite harmonic sound sequences. To date, no exact theory was developed that would provide a consistent description of music perception process in context of wide range of techniques and means of expression used by composers. Similarly, we lack appropriate experimental procedures creating a framework in which individual aspects of the music perception phenomenon could be measured. The research work carried out currently in this area is aimed at lying the foundations for such theory an includes studies on long-term processing of acoustic information by the human hearing system, the effect of memory processes on auditory perception, relationship between the sound material arrangement pattern in a musical piece and the ability to recognize functional interdependence in the key, rôle of symmetries and breaking them in this arrangement (especially with respect to tonal or atonal nature of perception, perception dependencies in the consonance-dissonance relationship, and many other issues.

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A study on directivity characteristics of sound radiated from semi-infinite waveguide outlet

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The paper presents results of measurements of directivity characteristics produced by sound wave radiated from open outlet of unflanged cylindrical waveguide and comparison of the experimental data with directivity patterns obtained theoretically on the grounds of the mathematical model of semi-infinite tube with Neumann's boundary conditions. The physical representation of the model was a finite waveguide the opposite end of which was terminated with a strongly sound-absorbing material preventing reflection of the wave (the so-called anechoic termination). The system was excited by means of a point source located either symmetrically or unsymmetrically with respect to the waveguide axis in the vicinity of the termination. Frequencies of monochromatic signal applied to the source were selected in such a way that they fell between consecutive radial/circumferential mode cut-off frequencies so apart from the plane wave, also consecutive higher wave modes could be ob-

served with the increasing excitation frequency. In order to verify consistency between the obtained measurement results and predictions of the adopted theoretical model, the measurements were carried out in spherical coordinates allowing thus to obtain 3D directivity patterns. Thanks to the use of computer-controlled turntable in the measurement system, the presented results are characterized with high angular resolution equaling to 5° for the polar angle and 15° for the azimuthal angle.

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The identification of the sound power of sources in the presence of the incomplete information regarding their location

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The side effect of the human activities, especially in areas related to the acquiring of energy sources is a varied environmental pollution. Therefore, it seems to be necessary to build a system for monitoring and managing the state of the environment. On the other hand, in order to enable the management of the environment status, it is essential to modelling the impact of the facilities on the environment.

In this paper is presented a system for monitoring and managing the state of the environment, which in its basic version focuses on the risks related to the noise. It allows to generate on demand the noise maps. For this purpose it was necessary to determine the sound power of sources. Because under real conditions the noise sources in the selected area can change its location, it seemed to be important to determine the effect of this change on sound power of the obtained values.

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Engineering modifications of resonance absorbers to reduce the impact of surface layers

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Resonance absorbers are readily used by architects to help mitigate the adverse acoustic phenomena occurring in various public buildings. They can be finished properly supply in any way in the framework of needs on a given object.

The current system is an acoustic pulp and cotton plaster fitted using air gap of different sizes. This system, in the basic version consists of patches of glass wool with a thickness of 20 mm, the base layer with a thickness of 3 mm and a finishing layer with a thickness of 2 mm. Finishing layer is made of the cotton fibers and the finely minced cellulose.

In this article has been analyzed the impact of the thickness of the slices constructed of glass wool, the size of the air gap and the finishing of the outer surface of the resonance absorber on the obtained sound absorption coefficients. With regard to the outer surface finishing have been tested the sample with a finishing layer applied by the manufacturer, and samples coated with additional single and double layer of paint.

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Shaping sound reflection on the edge of reflective panels

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The proposed research relates to phenomenon of sound reflection from a single reflective panel of finite dimensions and the spatial arrangement of many elements. There will be study the influence of side edge's shape on distribution of the reflected sound field. The analytical, numerical and experimental studies will take into account diffraction at the edge of panels, different distance from the source and receivers to reflective panels, different angle of incidence and reception of sound waves and also their impact on the sound reflection. The studies aim to develop a computational model that will better describe acoustic wave reflection from reflective surface than the currently used model derived only for flat and round elements. The expected result of the research will be clues to formulate guidelines for shaping panels' edges that provide even spatial and frequency distribution of acoustic field on the measurement area.

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Modeling of subjective evaluation of sound intensity leveling between violin strings

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The sound intensity leveling between the violin strings is a very important problem for violinists and violin makers. This property determines the usefulness of the instrument. If the leveling is very bad, a play on the violin is nearly impossible. Because of that, the leveling is always evaluated on violin making competitions. The evaluation of this violin's property is made by jurors of the competitions. This property can be also measured, but the relation between the objective parameters and the subjective evaluation is complicated. This work presents a modeling of subjective evaluation of the leveling. The modeling is based on a genetic algorithm and uses differences between strings expressed in dB. The AMATI multimedia database, which contains recordings and evaluations of the violins from 10th International Henryk Wieniawski Violin Making Competition, was used as a source of the violin sound and their subjective evaluations. Each violin was evaluated by four jurors. The three objective function were tested: a minimization of the mean square error, a minimization of the mean of errors and a minimization of the number of instruments, which the module of the difference between the calculated evaluation and subjective evaluation was less that one. The best result was obtained for the medians of the evaluations done by jurors, where 60% of the calculated evaluations were similar to the subjective evaluations.

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Effect of acoustic model input parameters to the range of wind turbine noise

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Since there are no dedicated methods for both measuring and calculation of noise emitted by wind turbines, reference

methods are used. Therefore modeling algorithms based on the standard ISO 9613-2. Algorithms of this standard include phisical phenomena such as absorption by the atmosphere, absorption through the ground and reflection from the surface, however, apply to sources located not far above the terrain. This requirement introduces doubt as to whether the standard algorithms are actually suitable, in particular the ground attenuation factor, wind speed and direction that change. Also, the sound power of turbine varies with the wind speed. On the other hand, in some areas, even small changes in the level of noise caused by the indicated factors may result significant changes in the noise.

Therefore, the present paper is an attempt to determine the qualitative and quantitative effects of changes in ground ratio G, temperature, wind speed and direction on the range of noise emissions from the wind turbine. The study used the wind farm located in Leki Dukielskie (Podkarpackie Province, Southeast Poland), consisting of five Repower MM92 turbines. Spectrum of sound power level (L_w) and sound level (L_{Aeq}), under varying conditions of wind turbine has been measured. The measurement results were used to verify the results of a calculation made using the universal software SoundPLAN that is dedicated for the analysis of environmental noise.

The paper has been performed within the statutory research of AGH Department of Mechanics and Vibroacoustics in 2010–2013.

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The sound absorption coefficient as a function of the active measurement volume

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This paper concerns the discussion about correctness of determination the sound absorption coefficient for the spatial structures in reverberation chamber. The currently used procedure, described in the PN-EN ISO 354, does not take into account changes in the volume of the chamber which result from measured sample geometry. After simplified calculations one has shown that disregard of the sample volume can result in measurement error in the range of 10%. In order to verify this problem the appropriate experiment was designed. In reverberation chamber there was mounted a specially constructed floor allowing to insert the sample at a given depth. Afterwards, using this measurement setup, there was measured the sound absorption coefficient of upholstered chairs depending on the depth of their installation. Research analysis with discussion of measurement error allowed to formulate the concept of further studies on the impact of measurement area changes on the sound absorption coefficient of different spatial structures.

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