PAN ARCHIVES OF ACOUSTICS
Vol. 40, No. 3, pp. 429–446 (2015)

DOI: 10.1515/aoa-2015-0044

Chronicle

62nd Open Seminar on Acoustics

and

91st Seminar of Czech Acoustical Society

Wrocław – Świeradów Zdrój, Poland, September 7–11, 2015

Abstracts

The Study on Usage of Personal Music Players among University Students in Slovakia

Argalasova Lubica, Filova Alexandra, Hirosova Katarina, Vondrova Diana, Samohyl Martin, Jurkovicova Jana, Sevcikova Ludmila

Institute of Hygiene, Faculty of Medicine, Comenius University
Spitalska 24, 813 72 Bratislava, Slovakia

The study is aimed to quantify the effects of social noise exposure (personal music players (PMP), events with high noise exposure) and the exposure to the other environmental noise sources in the selected sample of Slovak university students aged 19–23 years. The validated methodology according to ICBEN was used to assess noise annoyance. The measurement of ambient noise levels was done using hand-held sound level analyzer. There were 526 university students (143 males and 383 females, average age 23.09 ± 2.23) enrolled into the study so far, 192 in the exposed housing facility and 326 in the control housing facility in Bratislava. The social noise exposure (personal music players, events with high noise exposure) was quantified and followed according the authorized methodology of the study Ohrkan (Bavarian Health and Food Safety Authority, Munich). From the total sample 416 (79.4%) students reported the use of PMP in the last week for the average time of 314 minutes. There was a significant difference in PMP use between the exposed (85.34%) and the control group (76.31%) ($p = 0.01$), but no significant difference between males and females ($p = 0.43$). More than 10% of students listen to the music on the loudness level 4 (they cannot hear the speech or even the traffic) and more than 80% (84.68%) use earbuds. Among PMP users 28.1% exceeded the LAV (lower action value for industry = 80 dB). The results showed the importance of road traffic and the social noise as well and the need for prevention and intervention in these vulnerable groups.

⋆ ⋆ ⋆

The Impact of Relative Humidity Compensation Methods on the Sound Absorption Coefficient in the Physical Model of a Reverberation Chamber

Baruch Katarzyna, Kamisiński Tadeusz

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The main problem that occurs during acoustic measurements associated with physical model of the room is too high sound absorption through the air for the higher frequency range. Considered issue is the difference in values of sound attenuation received in a reverberation chamber and its scale model – the values measured in scale model for normative temperature and relative humidity are several times higher than those determined on the basis of the similarity theory formulated by FH van den Dungen in 1934. The paper describes a comparison of four methods used to compensate relative humidity of the air in room models in terms of their impact on the reverberant sound absorption coefficient for two measurement samples made in 1:8 scale. Samples which were selected for the measurements are equivalent to full-sized, commercial materials and acoustic structures. They are also used to acoustic treatment in different types of interiors. Acquisition of the impulse responses and calculation of the sound absorption coefficients were performed in reverberation chamber model made in 1:8 scale compared to the full-size reverberation chamber placed in Department of Mechanics and Vibroacoustics at University of Science and Technology in Krakow.

⋆ ⋆ ⋆

Simulation Experiments with One Tap Update LMS Algorithm in Application to Active Control of Sound

Bismor Dariusz

Institute of Automatic Control,
Silesian University of Technology
Akademicka 16, 44-100 Gliwice, Poland

Expansion of new, sophisticated algorithms and the need for longer adaptive filter generate the interest in partial update adaptive algorithms. Among the Partial Updates the Partial Update LMS algorithms are of particular interest due to popularity of the LMS algorithm. In this paper we show that smart use of the Partial Update LMS algorithms does not necessarily mean degradation of performance of the adaptive algorithm, e.g. degradation of convergence speed. Moreover, even in the extreme case of updating only one tap out of possibly hundreds filter tap may still result in a good overall performance. This is even true for the demanding active control of sound application.

⋆ ⋆ ⋆

Measurements of Vibration Properties of Mini Actuators

Bolejko Romuald

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

In the papers the measurements results of vibrational properties of miniature actuators are presented. The miniature ac-

tuators can be used in vibroacoustical measurements of light and delicate structure, e.g. damping measurements of bones or foils, miniature prosthesis etc. Three actuators have been tested: bone conductor used in audiometric tests, plate and ring CMA multilayered piezo actuators. Frequency response, displacement distribution on its surfaces and nonlinear distortions were developed. It was shown that piezo actuators generate vibrations with amplitude up to several nm in wide frequency range (100 Hz – 20 kHz) and vibrate as a rigid piston in its useful frequency range. Whereas the bone conductor vibrates with several times higher amplitude but in narrower frequency range the bone conductor vibrates also as a rigid piston in wide frequency range.

⋆ ⋆ ⋆

Acoustics of Chamber Concert Hall of Newly Built House of Polish National Radio Symphony Orchestra (NOSPR) in Katowice

Bolejko Romuald, Kozłowski Piotr Z.

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

In the paper room acoustics of the Chamber Hall of newly built House of Polish National Radio Symphony Orchestra in Katowice (NOSPR – polish abbreviation) is presented. Design parameters and methods are introduced and discussed. Results of computer modeling and post-completion measurements are also presented. Generally statistical, geometrical and wave acoustics methods during design process have been used. Statistical method was applied to determine reverberation in hall, geometrical acoustics method was used to define geometry of acoustic ceiling and geometry of side walls while wave theory was introduced to predict diffusing of walls lining. Down scaled model (1:20) has been also built in order to verify results of computer modeling. Modeling and measured results of acoustical parameters of the Chamber Hall are presented and discussed.

⋆ ⋆ ⋆

The Use of Auralization Methods to Study the Balance between an Orchestra Pit and a Stage

Brawata Krzysztof[1], Kamisiński Tadeusz[1], Pilch Adam[1], Rubacha Jarosław[1], Baruch Katarzyna[1], Szeląg Agata[2]

[1]Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

[2]Institute of Structural Mechanics,
Faculty of Civil Engineering,
Cracow University of Technology
Warszawska 24, 31-155 Kraków, Poland

The paper presents the results of research concerning the balance between a soloist on the stage and an orchestra in the pit. So far, the works on balance issues have focused on determining how to conduct the research and assess the quality of an interior based on some objective parameters such a measured sound strength G or its proportions. Moreover, there is little information on the subjective assessment of the balance and accordingly preferred room acoustic conditions. The authors tried to determine the preferred listening conditions using the auralization methods. The study was carried out for various configurations of orchestra in a pit and soloist settings on the stage. The study has confirmed the effectiveness of the auralization methods for such analyses. Furthermore, there was pre-defined the correlation between subjective and objective assessment of some acoustic parameters.

⋆ ⋆ ⋆

Isotropic Acoustooptical Interaction in Raman-Nath Configuration – Multiray Approximation

Bukowski Roman

Institute of Physics, Centre for Science and Education,
Silesian University of Technology
Konarskiego 22B, 44-100 Gliwice, Poland

Not available.

⋆ ⋆ ⋆

Research on Crosstalk in Commercial Ultrasonography Arrays

Celmer Mateusz, Opieliński Krzysztof J.

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

Ultrasonography (US) devices are now commonly used in medical diagnostics for safe and non-invasive visualization of the interior of the human body in vivo. Ultrasonic arrays used in these devices consist of multiple elementary ultrasonic transducers in the form of fine-cut or notched rectangular narrow piezoceramic plates. These plates are mounted alongside in a suitable manner, embedded with a damping layer in the back and covered with several layers at the front to match the acoustic impedance of piezoceramics to the impedance of soft tissue. In such an electromechanical construction, with electrical stimulation of various elementary transducers, mechanical vibrations and electrical voltages are transferred to the adjacent transducers in the form of the so-called crosstalk. Electrical crosstalk results in noise which limits the dynamics of ultrasonic images and the appearance of unwanted pulses which distort the image. Mechanical crosstalk results in the distortion of the directivity of the ultrasonic wave transmitted or received through the aperture of the array, which leads to the formation of side lobes. Due to the continuous improvements in the design of ultrasonic arrays and higher resolutions of measurements, crosstalk is increasingly seen as one of the major causes contributing to worsening of the quality of ultrasonic imaging. This is why the studies aimed at identifying their sources and finding the ways to minimize them become very important. In the present study, we have investigated similar but qualitatively different two commercial ultrasonography arrays from different manufacturers (Alpinion Medical Systems and Greatrend Medical) for analysis of electrical and mechanical crosstalk and their causes. The study has shown the symmetry of mechanical crosstalk about the activated transducer, with a very fast fading of amplitude at transducers located further than those immediately adjacent to the actuated one. The amplitude of mechanical crosstalk for the array identified as a better one is significantly lower. It was also shown that the electrical crosstalk largely depend on the location of electrical paths from the individual electrodes to elementary transducers relative to the activated transducer.

⋆ ⋆ ⋆

The Methods of Secondary Pressure Calibration of Measurement Microphones Realized at the Central Office of Measures – National Metrology Institute in Poland

Dobrowolska Danuta, Bugalski Marek, Młyńska Aleksandra

Central Office of Measures (GUM)
Elektoralna 2, 00-139 Warszawa, Poland

The methods of secondary pressure calibration of measurement microphones as well as measurement systems used for calibration at the Central Office of Measures (GUM) are presented. Particular emphasis is placed on the simultaneous comparison calibration performed according to IEC 61094-5 using Bruel & Kjaer type WA 0817 active coupler and Microphone Calibration System type 9721 based on the PULSE System type 3560.

The examples of results obtained for different microphone models and configurations and estimated measurement uncertainties are discussed. The limitations of the methods used currently at the GUM and the plans of development of the measurements systems in order to eliminate these limitations are highlighted.

⋆ ⋆ ⋆

Mode Matching Method for Annular Horns

Evensen Karen Brastad[1], Kolbrek Bjørn[2]

[1]Cowi, Norway

[2]Acoustics Research Centre,
Department of Electronics and Telecommunications
NTNU – Norwegian University of Science and Technology
O.S. Bragstads Plass 2, 7491 Trondheim, Norway

Horns and other types of ducts can be simulated by the Mode Matching Method (MMM), in which the sound field inside the horn is described in terms of orthonormal mode functions appropriate for the geometry in question. In order to simulate expanding ducts, the duct is divided into short, straight segments, and the modes are coupled across the discontinuities. The equations for such couplings have previously been described for cylindrical and rectangular geometries. In this paper, the MMM is extended to annular geometries. The equations for coupling two annular ducts, or one annular and one circular duct, are presented. Results are presented and shown to be in good agreement with the Boundary Element Rayleigh Integral Method.

⋆ ⋆ ⋆

Automatic Differentiation between Normal and Dysarthric Speech

Felcyn Jan[1,2]

[1]Gido Labs Sp. z o.o. [Ltd.]
Romana Maya 1, 61-371 Poznań, Poland

[2]Institute of Acoustics, Faculty of Physics,
Adam Mickiewicz University
Umultowska 85, 61-614 Poznań, Poland

Speech is one of the most natural ways of communication for human beings. Unfortunately, verbal communication can be a challenge for people with speech disorders. Therefore, those people suffer from a variety of emotional and psychological problems related to interaction. Early diagnosis and treatment is essential to minimize those symptoms. To speed up the process, several automatic procedures for speech disorders detection have been proposed by researchers. In this paper, we focus on two recently published methods (Envelope Modulation Spectra, EMS and Multidirectional Regression, MDR) and we apply them to differentiate between normal and disordered speech of polish speakers. Our experiments showed that both techniques efficiently perform this discrimination task. In particular, MDR method recognized disordered speech with above 90% of accuracy. This research is granted by the National Centre for Research and Development (grant LIDER/032/637/L-4/12/NCBR/2013).

⋆ ⋆ ⋆

Analysis of Opportunities to Reduce Noise Generated by the Refrigeration Appliance

Flach Artur[1], Kamisiński Tadeusz[1], Brawata Krzysztof[1], Declerc Thomas[2]

[1]Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

[2]Ecole Centrale de Lille Cité Scientifique
CS 20048 59 651 Ville neuve d'Ascq, Cedex France

Development of new technologies and strong competition on the market lead to intensified efforts to reduce the noise emission from refrigerators. One example is using a sound-absorbing material to reduce the sound power level of a laboratory refrigerator. This presentation shows the trade-off between the efficiency of heat radiation and absorption of sound. We present sound-absorbing that allow sufficient exchange of air. As the frequencies above 1 kHz are present in the noise spectrum, directional characteristics of the sound sources very interesting and was taken into account in finding proper solution. Based on measurement of the refrigerator's temperature, air flow and sound pressure, the optimal materials and configuration of the sound absorber was selected. Efficiency of the proposed solution was demonstrated by comparing the acoustic power levels that was measured in anechoic chamber.

⋆ ⋆ ⋆

The Sound Field of a Single Higher Mode Generated in a Cylindrical Duct by Means of the Constructed Planar Mode Synthesizer – Theory and Experiment

Gorazd Łukasz, Snakowska Anna,
Jurkiewicz Jerzy, Kolber Karolina

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The paper presents the theoretical predictions and experimental results of the acoustic field generated by a single user-selected mode propagating in an infinite hard duct. Theoretical analysis and many experimental results indicate that accounting for the presence of higher cut-on modes is crucial for obtaining compatibility between theoretical and experimental results. In many in-duct experiments carried out by many experimenters including the authors of the paper, it has been confirmed, that the cut-on mode with the highest cut-on frequency is excited with the greatest amplitude. As a result with increasing value of the reduced frequency ka description of the field becomes more and more complex, especially when propagation conditions in a semi infinite unflanged duct are considered. It seems obvious, that propagation of a single mode would substantially reduce complexity of the field analysis, especially determination of reflection/transformation or scattering coefficients from the experimental data to examine discrepancy between theoretical and experimental results. A possibility of excitation inside a duct of a single user selected radial or circumferential mode for the reduced frequency allowing for propagation at least few higher modes has been achieved by constructing a planar mode synthesizer composed of up to 13 point sources each of which has been driven by a separate loudspeaker. The amplitude and phase of each signal necessary to generate a single mode were determined in two different ways – by means of the in-duct Green's function method and by the modal decomposition method. The outlet of a thin tube, which omnidirectional directivity characteristic has been proved experimentally, served as a practical realisation of a mathematical model a single point source. The construction of the mode synthesizer allowed it to rotate within the full azimuthal angle. The microphone measuring the acoustic pressure inside the duct was capable to move along the duct radius and change automatically its position each time the mode synthesizer made a full rotation. Combination of these two motions allowed measuring the acoustic pressure with high resolution. Some single modes have been successfully produced by means of the presented experimental set-up.

⋆ ⋆ ⋆

Ultrasonic Transmission Tomography – Possibilities and Limitations

Gudra Tadeusz

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

This study presents an assessment of the capabilities of a method of visualizing the internal structure of various ob-

jects based on ultrasonic transmission tomography (UTT). The method makes it possible to reconstruct structures' heterogeneity on the basis of several acoustic measurements: propagation velocity of ultrasonic wave, attenuation, derivative of the ultrasound attenuation coefficient in relation to frequency and nonlinear B/A parameter. The study presents an assessment of measurement errors related to the measurement setup geometry. It also covers an assessment of the possibilities of achieving maximum imaging resolution using this method, in comparison to, e.g. internal structure imaging that utilizes solutions used in ultrasonic microscopy. Images of selected structures obtained with the UTT method are presented and visualizations of the same structures produced using an ultrasonograph (USG), computed tomography (CT) and magnetic resonance imaging (MRI) are compared.

⋆ ⋆ ⋆

Attention and Audiovisual Interaction in Context of Change Blindness and Change Deafness

Hafke-Dys Honorata, Siwka Agata, Preis Anna, Kociński Jędrzej

Institute of Acoustics, Faculty of Physics,
Adam Mickiewicz University
Wieniawskiego 1, 61-712 Poznań, Poland

Change blindness occurs when a significant change in a visual stimulus is introduced and the ob-server does not notice it. This mechanism has been argued to reflect fundamental limitations of human attention. Similar paradigm is observed in hearing. It is called change deafness and occurs when under certain circumstances, a large physical change in auditory stimulus goes unnoticed by the subject. In the current study two experiments were performed. Experiment 1 focused only on the change deafness paradigm, without taking into account vision domain. An auditory instruction was presented to the subjects. During playback, the voice reading the instructions was switched. When the instruction was finished, subjects were asked, whether they had noticed the change. Experiment 2 was conducted to check if a visual distractor could also affect auditory modality and cause a change deafness incident. Partici-pants were presented with audiovisual samples demonstrating street traffic. During playback, random symbols of geometric figures appeared on a screen. Subjects were asked to count, how many times a symbol of specified shape or color appeared. Simultaneously, additional images and sounds, that did not match the presented material, were introduced in the playback. After the presentations, subjects were asked to verify, which of the changes they noticed. The aim of both experiments was to examine whether change deafness occurs in certain experimental conditions, and whether the vision can affect the auditory domain and induce the change deafness phenomena. This work was supported by the grant from National Science Centre: Project Number UMO-2011/03/B/HS6/03709.

⋆ ⋆ ⋆

Application of Microphone Arrays and Acoustic Holography for Analysis of Acoustic Radiation from Vibrating Structures

Havranek Zdenek, Benes Petr, Liu Daipei, Klusacek Stanislav

Brno University of Technology
Technicka 3082/12, 616 00 Brno, Czech Republic

Paper deals with experimental analysis of acoustic radiation from thin rectangular plate by matrix microphone array measurements and near-field acoustic holography processing method. Comparison of simulated and experimentally evaluated acoustic pressure and surface velocity field has been carried out for harmonic point force driving of the structure in one of its fundamental mode. Simulated data has been obtained by finite element analysis in coupled structural and acoustic domain. Measured pressure field near the vibrating surface has been acquired with matrix microphone array equipped with laboratory capacitive microphones and further processed with acoustic holography method to obtain back-calculated e.g. predicted pressure and velocity field near the surface. True surface velocities have been measured by scanning laser vibrometer and later compared with predicted values based on acoustic holography. Also analysis of far field acoustic radiation of the structure based on near-field data has been performed to determine the areas of the vibrating structure contributing to this radiation. Attention is also paid to the correct choice of regularization in acoustic holography algorithm.

⋆ ⋆ ⋆

Frozen Bearings in Machine Base Isolation

Horvath Zoltan[1], Vanstraelen Michael[2]

[1]CDM Magyarország, Budakalasz, Hungary

[2]CDM, Overijse, Belgium

There is an increasing demand for vibration isolations in all shapes and forms these days. Buildings are being built closer to railways, tramways and metro lines, machines are installed closer to residential areas, or if nothing else, regulations become more and more stringent, and our expectations to comfort in living or working environment are getting higher and higher. When a machine is isolated, it will almost inevitably move more than without isolation. This can become even more critical if lateral isolation loses its resilience prematurely due to excessive use and overloading of the machine. Up to now, replacement of lateral strips or buffers in narrow gaps was next to impossible, but thanks to CDM's recent development of the "frozen bearing technology" (FBT), a simple, yet effective method is made available, and has been applied successfully at several occasions, as described in this case study.

⋆ ⋆ ⋆

Measurements on Relation between Window Technical Parameters and Acoustic Insulation

Jakubowski Piotr[1], Kuśmirek Magdalena[1], Kopaszewski Krzysztof[1], Weryk Mateusz[1], Panaś Marek[1], Adamczyk Jarosław[1], Kwapisz Leszek[2]

[1]Ship Design and Research Centre
Szczecińska 65, 80-392 Gdańsk, Poland

[2]Institute of Fluid-Flow Machinery,
Polish Academy of Sciences
Fiszera 14, 80-231 Gdańsk, Poland

This article describes relation between the window structure and its acoustic insulation of airborne sound. Since the glazing is the main structural component of the tested window, which is also dominant in the surface share, the most of manufacturers of glazing make laboratory tests and present some results of testing of sound insulation glass. It is obvious, that in order to be competitive on the construction joinery market the response to inquiries should be made as soon as possible, and should include the pricing of products with different variations of acoustic insulation at the lowest possible price. In presented research an acoustic radiation factor was used as main parameter in the vibro-acoustic analysis together with the amplitude of the vibration plane and finally related to acoustic insulation. Described assumptions are correct for the radiation factor in the case of continuous plane without any slots, and therefore the model will not apply to the construction of windows with diffusers. Practical knowledge of how to perform a window valuation, based on data acoustic insulation data, is now very desirable.

⋆ ⋆ ⋆

ArAc – Multibook of Architectural Acoustics

Jaruszewska Karolina

KFB Polska Sp. z o.o. [Ltd.]
Mydlana 7, 51-502 Wrocław, Poland

ArAc – Multibook of Architectural Acoustics is a didactic tool whose main objective is to increase architects' awareness about the role acoustic comfort plays in the life of human beings and to innovatively fill the gap in technical literature. The multibook is the first of this kind in the form of an acoustics manual for architects, enriched with audio, image galleries, animations, instructional videos and elements of interactive infographics. The outcome of the ArAc project is application of Architectural Acoustics available for free on tablets, smartphones and as an interactive PDF.

⋆ ⋆ ⋆

Active Structural Acoustics Control – Principles and Applications

Jiřiček Ondřej

Faculty of Electrical Engineering,
Czech Technical University
Technicka 2, 166 27 Prague, Czech Republic

Not available.

⋆ ⋆ ⋆

The Effect of Sonication on Acoustic Properties of Biogenic Ferroparticle Suspension

Józefczak Arkadiusz, Hornowski Tomasz, Król A., Molcan M., Leszczyński B., Timko M.

Adam Mickiewicz University
Wieniawskiego 1, 61-712 Poznań, Poland

Superparamagnetic iron oxide nanoparticles (SPION) synthesized chemically usually need the modification of the particle surface. Other natural sources of magnetic particles are various magnetotactic bacteria. Magnetosomes isolated from magnetotactic bacteria are organelles consisting of magnetite (Fe_3O_4) or greigite (Fe_3S_4) crystals enclosed by a biological membrane. Magnetotactic bacteria produce their magnetic particles in chains. The process of isolation of magnetosome chains from the body of bacteria consists of a series of cycles of centrifugation and magnetic decantation. Using a high-energy ultrasound it is possible to break the magnetosome chains into individual nanoparticles – magnetosomes. This study presents the effect of sonication of magnetosome suspension on their acoustic properties that is speed and attenuation of sound. Acoustic propagation parameters are measured using ultrasonic spectroscopy based on FFT spectral analysis of the received pulses. The speed and attenuation of ultrasonic waves in magnetosome suspensions are analyzed as a function of frequency, temperature, magnetic field intensity and the angle between the direction of the wave and the direction of the field. This work was supported by a Polish National Science Centre grant, no DEC-2011/03/B/ST7/00194.

⋆ ⋆ ⋆

Using the CAE Acoustic Camera for Environmental Noise Source Identification

Junek Pavel

Czech Acoustic Society
Technická 2, 166 27 Praha 2, Czech Republic

Not available.

⋆ ⋆ ⋆

Acoustics of Theater Halls in the Presence of Diverse Theater Forms

Kamisiński Tadeusz[1], Pilch Adam[1], Flach Artur[1], Rubacha Jarosław[1], Declerck Thomas[2]

[1]Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

[2]Ecole Centrale de Lille, Cité Scientifique
CS 20048 59 651 Ville neuve d'Ascq, Cedex, France

The evolution of theater forms prompts functional adjustments of theater halls, and as a consequence a change of acoustic parameters of the stage and the audience. A particular challenge for acousticians is adaptation of an old theater to the needs of a contemporary theater performance, for example changing position of the stage with respect to the audience. In this case, traditional elements as a stage window or balcony are no longer effective in directing the first sound reflection from the stage. This problem has motivated the authors to find hybrid acoustic solutions. The problem is illustrated by the case of the Municipal Theater in Gliwice that was built in 1890 and is currently being prepared for renovation. The authors have measured the acoustic parameters of the main hall and then simulated their values for several positions of the stage and mobile sound-reflecting and absorbing surfaces. Analysis of the results has shown that the sound strength (G) and the stage parameters (ST) are particularly useful during architectural design of the theater hall.

⋆ ⋆ ⋆

Actran Acoustics – Powerful Acoustic Simulation Software – Software Presentation

Karlińska Agnieszka

EC Engineering Sp. z o.o. (Ltd.)
Opolska 100, 31-323 Kraków, Poland

Actran is the premier acoustics software to solve acoustics, vibro-acoustics, and aero-acoustics problems. Used by automotive manufacturers and suppliers, aerospace and defense companies, and consumer product manufacturers, Actran helps engineers better understand and improve the acoustics performance of their design. Capability of the software and sample of applications will be presented during presentation.

⋆ ⋆ ⋆

Pilot Testing of Infrasound Climate in the Niepołomice Forest

Kasprzak Cezary, Ozga Agnieszka, Mleczko Dominik, Piechowicz Janusz

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

Infrasound, or acoustic waves with the frequency below 20 Hz, mostly occurs as components of the acoustic background in the natural environment. In the context of acoustic ecology, of particular importance is how infrasound propagates and how they impact on living organisms. The fact that living organisms are able to well adapt to their environmental conditions suggests that the natural acoustic spectrum provides the optimal living conditions. Technological progresses, development of industrial infrastructure and transport systems have changed the natural acoustic climate, also in terms of infrasound. The study summarizes the results of pilot testing of the acoustic climate and the presence of infrasound in the Niepołomice Forest, the area protected under the European Ecological Network program Natura 2000. Field measurements were taken of infrasound propagation in the Niepołomice Forest and the acous-

tic measurement data were used to evaluate the current acoustic climate conditions in the context of the presence of infrasound.

⋆ ⋆ ⋆

Fourier Method in 2D Acoustic Boundary Problem with Impedance Boundaries

Kocan Anna, Brański Adam

Acoustics Laboratory,
Faculty of Electrical and Computer Engineering,
Rzeszow University of Technology
Powstańców Warszawy 12, 35-959 Rzeszów, Poland

Fourier method is used to find the acoustic field with uniform acoustic impedance imposed on the walls. The representative, rectangular cross-section of the room is considered. Fourier method requires modal analysis. For this purpose an eigenvalue equation is solved graphically, and then eigenfunctions are found. Finally, the forced acoustical field is calculated. It has been shown that the Fourier method is useful and effective approach to given above problem. Theoretical considerations illustrated by numerical calculations. It is obtained the confirmation of the expected results.

⋆ ⋆ ⋆

Phonemes Distortion in Public Address Systems

Kochańska Iwona, Lasota Henryk

Gdansk University of Technology
Gabriela Narutowicza 11/12, 80-233 Gdańsk, Poland

The quality of publicly addressed voice messages in speech reinforcement and public address systems depends on a number and distribution of loudspeakers. Linear superposition of time-shifted broadband waves of a same form and slightly different magnitudes that reach a listener from numerous coherent sources is accompanied by interference effects leading to a deep modification of the received signal waveform. The paper presents the results of simulations of the impact of the multiplication of sound sources on formants as parameters important for speech intelligibility. The results are illustrated with the distributions of LPC filter poles, modeling the vocal tract, for Polish phonemes in their original version and distorted in the listening area.

⋆ ⋆ ⋆

Ambisonic vs. Binaural Subjective Assessment of Environment

Kociński Jędrzej[1], Wojaczek Kacper[1], Fouéré Ludovic[2]

[1]Institute of Acoustics, Faculty of Physics,
Adam Mickiewicz University
Umultowska 85, 61-614 Poznań, Poland

[2]École Centrale de Nantes
1 Rue de la Noë, BP 92101, 44321 Nantes cedex 3, France

There exist two different approaches to environmental acoustics. The first one is based on the assumption that sound in the environment must be managed and reduced. This is often called environmental noise control, and is based on measurements of objective characteristics of the sound. However, it appears that our preference is not as related to sound level as the noise management approach suggests. Therefore the second approach is based on the assumption that a sound in the environment is not necessarily a waste, but a resource that can be modified and used again. This approach is related to soundscape concept. Furthermore, in contrast to environmental noise control, in which the main goal is to reduce the sound level of noise (related perceptually only to discomfort or annoyance), this approach differentiates between wanted and unwanted sound sources. It must be emphasized that the most important factor in a soundscape is how the acoustic environment is perceived and assessed by people. From this point of view soundscape exists through human perception within the context of a particular time, place and activity. Since so many factors can influence our assessment of environment it is very difficult to measure it without influence of any measurement method. Moreover, too many factors change continuously in the environment, thus it is also impossible to measure it in situ with many subjects. The solution is to record the environment and present it to the subjects in controlled and repeatable conditions. The question is, however, how to record and present the environment not to influence the results. This work presents two different methods of recording environmental sounds, namely binaural and ambisonic. The binaural recordings were carried out using Head Acoustics SQadriga II with BHS II binaural headset while ambisonic ones were carried out using ST450 MKII SoundField Portable set. Then all the recordings were presented to the subjects in the anechoic chamber with Sennheiser HD 600 headphones (binaural signals) or via 25.1 ambisonic system of 25 Yamaha HS50M active loudspeakers and Velodyne subwoofer organized in a cubic geometry (ambisonic signals). Moreover, to take into account the context of the environment the visual samples from the environment were also recorded in HD quality using Canon XF 100 camcorder and shown in the anechoic chamber using NEC NP-PA500U projector on a 3m x 2m wide perforated screen. After a presentation of each audio-visual sample a subject was asked about the annoyance of the presented environment (using standardized ICBEN scale) as well about the subjective feelings about the way of presentation and its similarity to natural environment. This work was supported by the grant from National Science Centre: Project Number UMO-2011/03/B/HS6/03709.

⋆ ⋆ ⋆

The Research of Elements which Reduce the Acoustic Power Radiated from Cylindrical Duct Outlet and Modify Its Directivity Distribution Pattern

Kolber Karolina, Gorazd Łukasz

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

Outlets of ventilation and air condition ducts as well as exhaust of combustion engines are typical sources of arduous noise and therefore any attempt to reduce the sound level emitted by outlet of such systems is considered as deserving attention. One method of influencing noise emission properties of acoustic duct outlets consists in undertaking an intervention in their directivity patterns and shaping them in a way minimising the noise emission towards the areas occupied by people redirecting at the same time the sound energy flux into regions where it will not pose any significant problem. If the problem of the semi-infinite cylindrical unbaffled waveguide is concerned, its analytical solution is known and allows determining directivity patterns for the related outlet configuration, but must be accepted that for more complex geometrical forms of cylindrical duct outlets it will be necessary to use advanced numerical methods. The paper presents a number of directivity patterns obtained on the grounds of both laboratory measurements and numerical simulations for circular duct outlets characterised with various geometrical features for which analytical solutions, due to their complexity, are not known. Sound damping properties of locally/non-locally reactive materials integrated into a waveguide are examined by measuring the acoustic pressure on the cross-sections with and without the damping segment. Different variants of damping segments, e.g. made of perforated/microperforated material backed with annular cavities of different diameters filled with foam-damping materials will be the subject of the measurements. The study is consistently carried out based on the infinite/semi-infinite circular duct model, i.e. with anechoic terminations closing either both or only one end of the duct. The experimental set-up is equipped with a proprietary high-resolution measuring apparatus allowing to measure both

acoustic field distribution inside the duct and directivity characteristics of its outlet in a large anechoic chamber operated by AGH University of Science and Technology.

⋆ ⋆ ⋆

Patchwork Acoustic Screens and a Sense of Aesthetics in Landscape

Kompała Janusz, Kozerska Katarzyna

Central Mining Institute (GIG)
Pl. Gwarków 1, 40-166 Katowice, Poland

Increasing road, rail and air traffic as well as industrial activity generate a noise being a pollution of the environment observed in recent years, especially in urban areas. Recently, during the so-called "road boom" a tendency to build acoustic screens as the only and final action aimed at the reduction of pollution of the environment by noise has been observed. The erected acoustic barriers by their form, dimensions and colours become an excessive interference in the landscape, disturbing its visual perception and often cause a sense of landscape disorder to a potential recipient. Very interesting engineering solutions of acoustic barriers are screens made in the Patchwork style which act as "landscape wakers". However, an incompetent use of their colour diversity and a chaotic juxtaposition of the panels into the whole may take a form of an aggressive syncretism instead of composition coherence. That is why a careful selection of anti-sound barriers is very important already at the design stage of a road investment, because a wrong selection may result not only in an increase of the costs associated with maintenance and conservation, but also in the destruction of the landscape which is protected by the European Landscape Convention. Decisions, not entirely considered, of the people responsible for the discussed area, relating to the construction of further acoustic screens, often violating the principle of sustainable development, result in the division of landscape with vertical bulkheads into enclaves in which residents are trying to live and to function. The article discussed the problems associated with planning acoustic screens in landscape, their aesthetics, form and composition, as well as their effectiveness in the environment.

⋆ ⋆ ⋆

Aeroacoustics Studies of Prepared Wings of Various Species of Owls

Kopania Joanna

Department of Fundamentals of Technology
and Industrial Ecology,
Institute of Social Sciences and Management of Technologies,
Lodz University of Technology
90-924 Łódź, Piotrkowska 266, Poland

Noise is regarded as an environmental stressor that can interfere with daily activities. So the engineer's responsibility behind acoustics environment becomes more important. In nature can be found good examples of effective noise reduction like motion of cat (the soft pillow on the bottom of the feet, membranous wings of bats or the specialized structures of owls wings). Many species of owls have the ability to fly silently. These fascinating animals are capable of some amazing physical feats, such as the ability to fly through the air in virtual silence. The quiet owl in both gliding and flapping flight generates noise at low frequencies below 2 kHz, which is below its prey's hearing range. This ability to fly silently has long been a source of inspiration for solutions of quieter aircraft and fluid machinery. There are two types of species of owls, called – good seeing and called – good hearing. There are also differences between in shape of leading and trailing edges for these species of owls. So in this work we checked differences in geometry and shape the edges of the wings of owls by using the Stereo Microscope. Also acoustical parameters for low-Reynolds numbers were studies on constructed stand test with the outlet to the anechoic room.

⋆ ⋆ ⋆

Speech Reception Threshold for Polish Sentence Test (PZT). Does the visual information improve the speech intelligibility?

Kordus Monika

University of Medical Sciences
Fredry 10, 61-701 Poznań, Poland

The study was carried out to determine whether cross-modal relations occur during processing of auditory and auditory and visual perceptionț. A group of ten adults with normal hearing participated in the study and were evaluated on two auditory tasks. Speech Reception Threshold (SRT) without visual hints and SRT with visual hints were evaluated. Subjects were presented with the Polish Sentence Test (PZT) in noise. In the first condition the subject's task was to repeat the words. In the second condition, a touch-screen monitor was placed in front of the subject to collect responses. The monitor was used to display a list of words in the SRT test. The subject chose from twelve words that appeared on the screen after the sentence was presented. The subject's task was to recreate the correct sentences from the available words that appeared on the screen. The words were displayed alphabetically and included all the words occurring in the sentence as well as alternate words. No differences in modality were found in each of the tasks tested for the subjects with normal hearing.

⋆ ⋆ ⋆

Speech Perception and Hearing Aid Procedures

Kordus Monika, Hojan-Jezierska Dorota

University of Medical Sciences
Fredry 10, 61-701 Poznań, Poland

The primary goal of the hearing aid fitting is to improve speech perception, especially in difficult listening conditions. A major decision at the time of the hearing aid fitting relates to the amount of amplification required to provide listeners with the appropriate compensation for sensorineural hearing impairment across a wide range of frequencies and input levels. A group of four subjects with different degrees of hearing loss were fit to the NAL-NL Berger and DSL [I/o] procedure. Evaluation was performed with the speech perception in free field and the AB-HAP questionnaire. Our preliminary results demonstrate variability across subjects for the same procedure tested as well as different subject's preferences in the fitting methods.

⋆ ⋆ ⋆

3D Sound Intensity Measurement around Organ Pipes Using Acoustic Vector Sensors

Kotus Józef, Odya Piotr,
Szczodrak Maciej, Kostek Bożena

Faculty of Electronics, Telecommunications, and Informatics,
Gdansk University of Technology
Narutowicza 11/12, 80-233 Gdańsk, Poland

The aim of the presented paper was to obtain and visualize sound intensity distribution of radiated acoustic energy around the organ pipes. The experimental setup consisted of the multichannel acoustic vector sensor and the specialized Cartesian robot. Measurements were performed in free field with spatial resolution of 0.1 [m]. Two organ pipes, i.e. wooden and metal were measured during the experiment. The organ pipes were activated using the air-compressor. Thus, it was possible to obtain a long-term steady state response. The multichannel sound card was used to record data from the acoustic vector sensor. The results were processed in order to visualize sound intensity distribution around each pipe. Results obtained for both organ pipes are compared and discussed in the paper.

⋆ ⋆ ⋆

Wave Equation – Universal Tool to Describe Wave Motion

Kozaczka Eugeniusz, Grelowska Grażyna

Department of Mechanics, Construction and Strength of Ship,
Faculty of Ocean Engineering and Ship Technology,
Gdansk University of Technology
Gabriela Narutowicza 11/12, 80-233 Gdańsk, Poland

Description of dynamic state changes in the media as a consequence of propagation of the local medium imbalances is typically done by using the wave equation. This equation has a phenomenal character, as it allows to describe wave phenomena in both the material media, as well as in a vacuum. In the area of acoustics applications generally we are dealing with material media that means the propagation of elastic waves. However, this applies mainly to solids and liquids. Electromagnetic waves may be propagated in the gas media. The nature of wave motion is mutual and cyclic conversion energy: kinetic and potential energy for elastic waves, magnetic and electric energy in the case of electromagnetic waves. The paper will present similarities in formal and phenomenal descriptions of wave motion both on a macroscopic and quantum scales. The system of equations characteristic for the wave motion in elastic media and vacuum, i.e. conservation equations and the equation of state will be used for this purpose. On this basis, references will be made characterizing the elastic and electromagnetic waves, including quantum phenomena.

⋆ ⋆ ⋆

Influence of Color for the Perception of Sound Frequency

Krawczyk Dawid, Brachmański Stefan

Chair of Acoustics and Multimedia,
Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

The paper presents the preliminary research which was focused on the influence of color for the frequency perception. In the framework of experiment the three basic colors were chosen: red, green and blue. The tonal signal (sinus signal of 1000 Hz and 700 Hz) was presented to the listeners when the color was displayed on the screen. In the same conditions the sound which was tuned off from the nominal frequency for 50 Hz or 30 Hz was presented to the listeners. The listeners had to state if the presented sound was the same, higher or lower frequency. The test was carried out in not ideal conditions of students' laboratory, so the influence of peripheral vision on the final result can occur. However the aim of presented experiment was to test if color or vision stimulus can influence the sound perception. The preliminary tests described in the paper were carried out on the population of 140 listeners.

⋆ ⋆ ⋆

Prototype of the Software for Support the Implantation of a Hip Endoprosthesis

Kruk Batłomiej[1], Marek Wojciech[2]

[1]Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

[2]Orthopaedics and Trauma Surgery Department
MSW Hospital Wroclaw
Ołbińska 32, 50-233 Wroclaw, Poland

The first stage of the research it was to create a database of acoustic characteristics of mostly used hip endoprostheses systems on the market. Database holds the results of resonance frequency measurements in different types of hip stems in a whole range of sizes. Data was collected intraoperatively in an operating theater and in an acoustic laboratory with the use of a saw bone in an anechoic chamber. Analysis of the collected results during a hip endoprosthesis stem implantation showed strong dependence of the resonance frequency distribution with harmonic components in dependence on how stem is implemented in hip. Operating theater tests showed differences in sound intensity between the beginning and the end of a stem implementation process. These differences might be used to inform a surgeon about a near possibility that a periprostetic hip fracture might occur. To manage all the dats a software prototype was made, that collects and analyses all sound signals during operation, and then informs the surgeon that his process of stem implantation is close to the moment, in which the periprostetic hip fracture might occur.

⋆ ⋆ ⋆

The Acoustic Properties of Thermoacoustic Devices

Kruk Bartłomiej, Dobrucki Andrzej

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

Research in thermoacoustics began with the observation of heat transfer between an acoustic wave and a solid material. Using this interaction an intense sound wave could be applied to create engines as well as heat pumps. In spite of the absence of any mechanical parts, like pistons, energy conversion from heat flow into acoustic power flow is performed in the stack. The most important part of thermoacoustic devices is a regenerator or stack, where the process of converting acoustic energy into thermal energy, or vice versa, is taking place. The aim of the paper is to present the properties of thermoacoustic prototypes (the impact of the material used to construct the regenerator and design parts of the acoustic system). Interest in thermoacoustic converters grows steadily. The can be used to convert heat into acoustic energy or to convert sound energy into heat, which can be used directly or easily converted to electricity. So far thermoacoustic technology was used only in the space industry. For the first time it may become applicable in a household.

⋆ ⋆ ⋆

Diagrams of Sound Speed and Parameter of Nonlinearity B/A for Different Models of Fluids

Kuśmirek Magdalena

Ship Design and Research Centre
Szczecińska 65, 80-392 Gdańsk, Poland

The article presents diagrams of the sound speed c and parameter of nonlinearity B/A for different fluids, gases and liquids, among them, for liquid water. There are many of different thermodynamic models for fluids, described in professional literature, from quite simple like an ideal gas (with modifications) to very complicated as semi-empirical ones, which take into account specific properties of a medium and interactions of molecules in it. In accordance with these approaches there can be obtained different formulas for c and B/A, and the calculated values can be compared to some experimental data. The analysis like this was conducted in the article, for considering what type of model is adequate for a specific medium and what physical properties play the dominant role in the tested fluid. It is known that one can use some simplifications and approximations of the thermodynamic state equations or the formulas for c and B/A, however every of mentioned media requires individual approach. The article is focused on the trends of the curves $c(T)$, $c(p)$ and made a number of assumptions and conclusions for physical characteristics of media, based on analysis of the behavior of mentioned curves.

⋆ ⋆ ⋆

Active Methods of Noise Attenuation in the Air Handling Unit Systems

Kuśmirek Magdalena, Jakubowski Piotr

Ship Design and Research Centre
Szczecińska 65, 80-392 Gdańsk, Poland

Air handling unit systems are used to exchange air in industrial facilities, offices and residential compartments. They are subject to a number of technical requirements, including the noise provisions, which lay down limits for the sound pressure level not only for sets of unit but at the outlets/inlets in ventilation ducts. Exceeding the permissible sound level is a problem of growing importance, due to the increase of acoustic restrictions and because of passive noise reduction methods which are insufficient. In this aspect active methods, called also "anti-noise" which do not reduce the air flow are very promising and require closer analysis. The article presents results of measurements made during the acoustic research project in CTO S.A., with using series of passive acoustic materials and with active noise cancellation system. The study shows that for passive dampers, the damping level is between 200 – 20 kHz, while the active system works in the range of 40 – 800 Hz. It follows that the active attenuation perfectly covers the low frequency band, which is reduced only to a negligible extent by the flow dampers conventionally used in ventilation systems.

⋆ ⋆ ⋆

Analysis of Sound Passing through the Window due to a Laser Vibrometer Measurements

Kwapisz Leszek[1], Radzieński Maciej[1], Jakubowski Piotr[2]

[1]Institute of Fluid-Flow Machinery,
Polish Academy of Sciences
Fiszera 14, 80-231 Gdańsk, Poland

[2]Ship Design and Research Centre
Szczecińska 65, 80-392 Gdańsk, Poland

The article presents an analysis of an acoustic insulation of a window in connection with vibroacoustical tests carried out using a laser vibrometer. Laser vibrometer studies enabled the mapping illustrating the forced vibrations of the window for different acoustic signals. The resulting vibration figures are helpful in explaining insulation curve.

⋆ ⋆ ⋆

Time-and-Space Structure of Force-Driven Rigid Sphere Wavefield

Lasota Henryk

Gdansk University of Technology
Narutowicza 11/12, 80-233 Gdańsk, Poland

An oscillating rigid sphere of a given velocity is traditionally taken for the physical model of dipole source of acoustic pressure. This paper introduces a time-domain, causality-inspired description of vector-source acoustic wavefield of arbitrary time evolution, where the sphere is practical realisation of a contact surface without which the source force would not be able to exert any impact onto a non-viscous fluid. At every space location, the resulting acoustic field is described by the pair of physical variables characterising time evolution of its two-fold dynamic state, viz. particle velocity "governed" by the vector wave equation, as a leading quantity, and acoustic pressure as the accompanying quantity related to the velocity by the divergence relation. This pair composes a fundamental solution for small-scale disturbance of acoustic medium, induced by properly coupled point-force source, namely the inert flow of fluid matter around the displaced spherical surface, accompanied by proper elastic deformation. The time and space structure of the solution is illustrated in the paper for some duly chosen cases.

⋆ ⋆ ⋆

Experimental and Numerical Study of Acoustic Pressure Levels in Duct for Obtaining Insertion Loss of Helicoidal Resonator

Łapka Wojciech

Department of Vibroacoustics and System Biodynamics,
Institute of Applied Mechanics,
Faculty of Mechanical Engineering and Management,
Poznan University of Technology
Jana Pawła II 24, 61-139 Poznań, Poland

This paper presents the study on obtaining insertion loss (IL) characteristics of helicoidal resonator. There were prepared experimental and numerical tests. The numerical simulations are compared to experimental results. The experimental test bench is based on European Standard EN ISO 7235, which describes the laboratory measurement procedure of insertion loss for ducted silencers. The specific IL characteristics of helicoidal resonator are similar in both types of results, experimental and numerical. The results of IL levels in the frequency domain below and on the resonance region of helicoidal resonator are interesting due to differences up to 5 dB.

⋆ ⋆ ⋆

A Study of Sound Insulation and Absorption Properties of Specimens Made by the Use of FDM Rapid Prototyping Technique

Łapka Wojciech, Augustyniak Agnieszka

Department of Vibroacoustics and System Biodynamics,
Institute of Applied Mechanics,
Faculty of Mechanical Engineering and Management,
Poznan University of Technology
Jana Pawła II 24, 61-139 Poznań, Poland

This paper presents the results of sound insulation and absorption measurements of plate elements made by the use of five types of filaments for rapid prototyping technique. PLA, PLA 45, PLA 90, ABS and Bendlay filaments were used for Fused Deposition Modeling (FDM) rapid prototyping technique to make fife types of plate elements. For sound absorption measurements the Kundt's pipe was used. To measure the sound insulation properties, a special test stand with isolated sound source was used. Thus, the acoustic standard PN-EN ISO 11546-2:2000 was implemented to determine the sound insulation performances of enclosures.

⋆ ⋆ ⋆

The effects of Voice Transmission Conditions on Forensic Automatic Speaker Performance

Maciejko Waldemar

Forensic Research Office (BBK),
Internal Security Agency (ABW)
Rakowiecka 2a, 00-993 Warszawa, Poland

The popularity of automatic speaker recognition as one of the methods of biometric human identification is constantly growing. The natural consumer of this type of technology is a bank sector. The voice biometrics is becoming supplemental to traditional security methods like password authentication. Another potential beneficiary of voice biometrics is forensic sciences. Forensic speaker identification experts may use not only aural-perceptual methods but also unbiased parametric analysis based on automatic recognition. VoIP technology is an effect of a widespread access to the internet and continued development of IP technologies, including wireless communication systems based on UMTS/HSPA, LTE and LTE Advanced standards. The most important advantages of VoIP are: lower costs of telephone conversations and possibility of parallel non-audio data transmission. According to telecommunication market predictions the role of VoIP is still growing. Despite the growing importance of packet switching systems, there is still

a shortage of thorough analyses of VoIP transmission effect on speech and speaker recognition performance. Voice over IP transmission systems uses packet switching. There is no guarantee of delivery. The main disadvantage of VoIP is a packet loss which has a major impact on the performance experienced by the users of the network. There are several techniques to mask the effects of a packet loss, referred to as packet loss concealment. The effect of GSM and PSTN transmission degradation on speaker recognition performance was a subject of many previous studies. All GSM and PSTN speech transmission phenomena lead to the decline of speaker recognition performance. The degree of degradation depends on transmission technology. Whereas there are no available reports that describe experiments of forensic automatic speaker recognition systems under voice over IP conditions, in this study, the effect of different codecs in connection with various packet loss rate and packet loss concealment methods on forensic automatic speaker recognition system performance was investigated. The analyzed system was based on MAP-EM-GMM modeling methods. The strength of forensic evidence, estimates using statistical models of within-source variability and between-sources variability and is expressed by a Bayes factor, so-called likelihood ratio. The performance was asses through so-called Tippet plots, which provide representation of proportion of cases with likelihood ratio.

⋆ ⋆ ⋆

Speakers Clustering Based on a Universal Background Model and MAP Adaptation

Makowski Ryszard, Hossa Robert

Faculty of Electronics, Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

While building an automatic system of speech recognition (ASR), one of the first steps is elaboration of acoustic model of the considered language on the basis of recorded speech samples and a GMM model. The same phonemes produced by different speakers are sometimes very different. What ensues is the flattening of GMM model probability distribution and, consequently, deterioration of its classification abilities. These differences are referred to as interindividual differences and they are caused by differences in the speakers' anatomy as well as their different personalities. Losses in the classification abilities of the acoustic model can be reduced by using additional algorithms referred to as compensation algorithms with preferred solution based on speaker clustering. The authors introduced a speaker clustering method based on adaptation of UBM model weights to obtain different acoustical models in each group. The proposed speaker clustering is an attractive solution to the compensation problem, as it does not require long utterances or high computational effort at recognition stage.

⋆ ⋆ ⋆

Acoustic Methods for the Detection of Selected Types of Stuttering

Malczyk Grażyna, Wszołek Wiesław

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

Stuttering is a disorder of fluency, occurring in both children and adults. It prevents free and smooth transition from one articulation to another, and to maintain an appropriate pace, rhythm and intonation of speech. In natural speech important is the intention of the transmission of information, which determines the rate of speaking and prosody used in a targeted manner. Pathological stuttering is accompanied by physiological symptoms, often combined with co-movements of the body, face, hyperactivity and spasticity. Emotionally it affects communication and social language. Inability to speak liquid leads to tension and stress of speaking. In problems of medical diagnosis, including planning and monitoring the therapy and rehabilitation of voice organs or speech-related organs, it is necessary to evaluate the qualitative features of the acoustic signal of deformed speech. One of the methods of testing which gives opportunities for a proper evaluation of the vocal folds in the process of stuttering, and the diagnosis of these disorders and for monitoring the progress of both, as well as the final effects of stuttering therapy is electroglottographic methods and acoustic spectral analysis of speech. In this paper we present the results of the speech signal stutterers. On the basis of these results, we developed a method of identifying types of stuttering.

⋆ ⋆ ⋆

Acoustics of Chosen UNESCO Wooden Churches in Poland

Małecki Paweł[1], Nowak Damian[2], Wiciak Jerzy[1]

[1]Department of Mechanics and Vibroacoustic,
Faculty of Mechanical Engineering and Robotic,
AGH University of Science and Technology
Mickiewicza 30, 30-059 Kraków, Poland

[2]Faculty of Sociology and History, Institute of History,
University of Rzeszow,
Al. Rejtana 16 C, 35-310 Rzeszów
National Heritage Board of Poland,
Regional Office in Rzeszów
Hetmańska 15, 30-045 Rzeszów, Poland

There are fourteen objects in Poland inscribed under the UNESCO's World Heritage List and two of them are wooden churches of the Southern Little Poland. Their architecture remains as a topic for many studies. On the other hand, its acoustics has not been given enough attention so far, despite the fact that it is a very important dimension. The issues discussed in the article are an attempt to bridge the gap. Spatial Impulse Response measurements were made and acoustic parameters were determined in particular wooden churches. Then, the churches came up for comparative analysis with reference to other objects of that kind. In order to do this, religious buildings that vary in terms of size, architecture and other aspects were chosen to be studied.

⋆ ⋆ ⋆

Creating a Numerical Model of Noise Conditions Based on the Analysis of Traffic Volume Changes in Cities with Low and Medium Structure

Marciniuk Karolina, Kostek Bożena

Audio Acoustics Laboratory,
Faculty of Electronics, Telecommunications and Informatics,
Gdansk University of Technology
Narutowicza 11-12, 80-233 Gdańsk, Poland

Almost 40% of a population of Poland has some type of a hearing impairment. This problem now affects younger generation and stops being the domain of the elderly people. One of the causes of hearing losses as well problems with the nervous and circulatory systems is a growing level of noise in cities. The subject of this research study was to analyze noise conditions of the selected area in the city of Gdańsk using data related to traffic volume changes during a day. The daily distribution of noise levels are much more helpful for noise control and reduction than traditional maps with L_{Aden} levels indicated. The study took into account the results obtained from the sensors of the City Noise Monitoring System and the results of the numerical model developed by the Multimedia Systems Department. The model was implemented on the supercomputer PL-Grid infrastructure. Calculations were performed for five places in close proximity to the sensors. The performance of road noise model was first compared with and then modified according to the values measured by those sensors. Through the changes of the number of

vehicles per hour in the numeric road noise model forty noise levels were obtained. Such an operation was repeated for each sensor. Those data were used in developing a reverse road noise model. It returned the number of cars per hour based on noise levels (L_{Aeq1H} – equivalent noise level for 1 hour period) from the city monitoring system. The experiment aimed at modeling of changes in noise levels and full day dynamic noise maps as a set of 24 noise maps, one for each hour of the day. The concept of dynamic noise mapping of the main cities might help with faster noise evaluation and avoidance actions such as traffic calming methods. These measures could make cities quieter and more transportation friendly, which is a major focus of the authorities of large cities. This is also essential to make corrections in living area conditions. Obtained maps can easily be distributed via the Internet because of the small size of the raster file.

⋆ ⋆ ⋆

Silent Sonar – State of the Art and Perspectives

Marszal Jacek, Salamon Roman, Jedel Andrzej

Faculty of Electronics, Telecommunications, and Informatics,
Gdansk University of Technology
Narutowicza 11/12, 80-233 Gdańsk, Poland

Military applications frequently require stealth and observations are conducted using devices emitting signals which are difficult to intercept and by the enemy. These are the particular features that silent sonar should have. The researchers from Gdansk University of Technology started work on this project in 2010. To ensure that silent sonar has the same detection capability as its pulse equivalent, the reduced sounding signal power is compensated with a longer proportional duration, which means that its energy is retained. An analysis was made of the detection conditions for sounding signals with frequency modulation and for signals using pseudorandom codes. A comparative analysis was conducted of the intercept ranges of the silent and pulse sonar. A laboratory model of silent sonar was built and tested confirming entirely the results of theoretical analyses. To reduce the error in measuring the distances and lowering the probability of intercept a new special sounding signal was developed and patented. The signal is a combination of hiperbolic frequency modulation and pseudo-random codes. Summary of achievements, currently ongoing works and prospects for further development and practical applications are presented in the paper.

⋆ ⋆ ⋆

Multiple-Error Adaptive Control of an Active Noise-Reducing Casing

Mazur Krzysztof, Pawełczyk Marek

Institute of Automatic Control,
Silesian University of Technology
Akademicka 16, 44-100 Gliwice, Poland

Low frequency device noise is a common problem in industry. Passively isolated device casings usually do not provide satisfactory noise reduction, especially if its frequency content varies in time. For effective reduction of such noise the passive barriers would have to be too thick, what is not accepted for practical applications. A possible approach is to actively control casing walls if they are made of thin plates. In the simplest solution each plate is controlled individually based on the measurement made by one error microphone located in front of it. For controllability reason a few actuators can be required for each wall. However, due to existing coupling between control systems for the plates, uncompensated paths in the adaptation can result in loss of stability of the whole multichannel adaptive system. The coupling can be reduced to some extend by using a rigid frame of the casing, but a mutual contribution of the plates still exists by the acoustic field. In this paper, an adaptive multichannel FXLMS algorithm is employed for controlling the whole casing, where controllers for each plate are tuned based on measurements at all plates. The proposed control system is experimentally verified and obtained results are reported.

⋆ ⋆ ⋆

Numerical Analysis of Sound Decay Process in Acoustically Coupled Spaces

Meissner Mirosław

Department of Intelligent Technologies,
Institute of Fundamental Technological Research,
Polish Academy of Sciences
Pawińskiego 5B, 02-106 Warszawa, Poland

The main aim of room acoustics is to predict reverberant properties of enclosures from measured or numerically simulated room responses. In this work this issue was examined in low-frequency range where acoustic characteristics of rooms is strongly frequency dependent due to differences in a damping of individual modes. A theoretical description of a decaying sound field was based on a modal expansion of the sound pressure and a reverberant response of the room was initiated by switching off a time-harmonic source or by emission of Dirac delta time impulse. Theoretical findings were employed to determine reverberant characteristics of enclosure containing two coupled rectangular spaces. Simulation results have shown that a sound decay after steady-state harmonic excitation is strongly influenced by the sound frequency and due to large fluctuations in a decaying pressure, numerical techniques for smoothing decay curves are needed. Calculations also revealed that in one-third octave bands the decay function found via backward integration of squared room impulse response may change very nonlinearly impeding a proper qualifying of nature of sound decay.

⋆ ⋆ ⋆

Parameters Defining the Area of Speech Intelligibility in Open-Plan Office

Mikulski Witold, Warmiak Izabela

Central Institute for Labour Protection
– National Research Institute (CIOP – PIB)
Czerniakowska 16, 00-701 Warszawa, Poland

The criteria for open-plan offices assessment are specified in the PN EN ISO 3382-3-2012 standard which was issued recently. They are based on estimating two parameters: distraction distance r_D (which is the maximum distance in which there exists the appropriate speech intelligibility), the privacy distance r_D (which is the minimum distance where the speech intelligibility is not appropriate already), the decrease in A-weighted SPL when the distance from the source was doubled, and the A-weighted SPL in the distance of 4 m from the source. These parameters are characterized by average properties of the whole room. They are obtained on the basis of STI and A-weighted SPL tests on straight and curves crossing workspaces. According to literature and researches made by the authors of the research paper it results that there is the need for verification how they are obtained as well as the criterial values of these parameters. Moreover, the authors of the research paper say that it is crucial to introduce a parameter which would be used to estimate acoustic separation of the particular work station, so the local parameter in relation to the work station in which this separation should take place. In the article the parameters are obtained in sample average open-plan office. There is also the typical example which needs acoustic separation.

⋆ ⋆ ⋆

Ribbon Loudspeaker

Nowak Tomasz

Chair of Acoustics and Multimedia,
Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

The inspiration for this project was to create a high frequency transducer, offering better performance (wider bandwidth, greater radiation angle in the highest octave, shorter transient response, reduced harmonic distortion, etc.) than the commonly used voice-coil dynamic speakers. Less common, nonconventional solution is to use a metal ribbon in a magnetic field for sound radiation. The transducer of this type is not built with adhered together base elements: voice coil, membrane and suspension. These three elements are replaced by thin strip of metal foil. In such an embodiment significant reduction of imperfections can be expected because of a smaller moving mass and higher coherence of vibration in all points of the ribbon. In the classic solution the membrane is excited at only one point. Such excitation causes resonances of the membrane, its breaking-up, destructive interference in sound radiation and irregularity of the frequency response. In the ribbon loudspeaker the entire surface is excited with approximately the same force and it vibrates uniformly, which allows avoiding the negative effects. To build a loudspeaker of this type, magnetic field in the air gap of magnetic assembly was modeled with using the FEM-method. The effect of application of the yoke made of magnetic soft alloy was also evaluated. The ribbon was cut out from 10 μm aluminum foil sheet. Some ribbons were corrugated with an especially designed tool. The properties of corrugated and smooth ribbons have been compared by measurement of the frequency responses and harmonic distortions. The loudspeaker is working with a transformer to match very low resistance of aluminum strip to the typical loudspeaker impedance levels between 4 and 8 Ω. In order to design the transformer, the electrical impedance as function of frequency of the ribbon together with connection terminals was measured. The influence of different inductance of both primary and secondary windings, with the same transformation ratio, has been evaluated and measured. The loudspeaker prototype was mounted in the normalized finite baffle and measured in the anechoic chamber. The frequency responses on and off the loudspeaker axis, in vertical and horizontal planes have been measured. The results of measurement confirmed very good features of the loudspeaker.

⋆ ⋆ ⋆

The Assessment of Acoustical Quality of Public Spaces

Nowicka Elżbieta

Building Research Institute (ITB)
Filtrowa 1, 00-611 Warszawa, Poland

The acoustical quality of public spaces is often a problem that confronts the architect and designer. Ensuring adequate speech reception in such spaces is one of the key factors determining the acoustic quality. The existing methods for the assessment of the acoustic properties of public spaces fail to provide full information on how to select architectural and acoustical parameters at the designing stage. The aim of that paper is to present an index-based method for the assessment of the acoustical quality of public spaces at the designing stage, taking into account selected architectural and acoustical parameters. Such a method would be expected to provide an assessment of a public spaces being designed in terms of speech intelligibility, as required, by applicable standards. That paper is focused on two types of the spaces: underground stations and sport enclosures.

⋆ ⋆ ⋆

Road Traffic Noise and the Rational Use of Noise Barriers

Nurzyński Jacek

Building Research Institute (ITB)
Filtrowa 1, 00-611 Warszawa, Poland

Road traffic noise influences the value of residential areas and affects the quality of life of their inhabitants. An acoustical barrier may locally reduce the sound level however its possible effect is relatively restricted and depends on a specific source-barrier-receiver configuration. Besides, noise barriers brink about different adverse side-effects which may be more disturbing than traffic noise itself. The question of rational and well-balanced use of acoustic barriers is discussed as well as the need for related formal requirements adjustments. Three basic noise situations are considered; a high-speed motorway outside urban areas with premises located in a certain distance form it, local roads running through a village close to single-family detached buildings, and residential areas in big urban agglomeration. An acoustic categorization of residential areas is proposed as an assessment tool for designers, developers and final users. It is also helpful for efficient urban development policy. The paper looks at the transportation noise problem from a spatial planning view point rather, because there is a growing need for holistic approach and harmonization of both; environmental and building industry attitude to the noise management policy.

⋆ ⋆ ⋆

Ultrasonic Tomography: Preliminary Results of Transmission and Reflection Studies of Biological Structures and Breast Tissue

Opieliński Krzysztof J.[1], Pruchnicki Piotr[1], Jóźwik Marcin[2,3], Majewski Jarosław[4], Bułkowski Mariusz[5], Gudra Tadeusz[1]

[1]Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

[2]Faculty of Medical Science,
University of Varmia and Masuria
Żołnierska 18, 10-561 Olsztyn, Poland

[3]Ginecology Department,
St. Raphael Hospital Scanmed
Bochenka 12, 30-693 Kraków, Poland

[4]Faculty of Telecommunications, Computer Science and Electrical Engineering,
University of Technology and Life Sciences
Ks. Kordeckiego 20, 85-225 Bydgoszcz, Poland

[5]DRAMIŃSKI S.A.
Owocowa 17, 10-860 Olsztyn, Poland

The breast cancer is the most common cancer among women in Poland and the second after the bronchi cancer leading cause of death in women. The breast cancer can be curable if is detected before metastases occur. Unfortunately, not all breast cancers are palpable in the study. Moreover, some of breast cancers can not be visualized using standard ultrasound scanners or by means of mammography. We need new and better imaging methods to improve the detection of the breast cancer. This paper presents preliminary results of examinations of biological structures and a healthy breast tissue *in vivo*, obtained by means of the ultrasonic tomography device model, which has been developed for several years by the Polish producer of medical devices – DRAMIŃSKI S.A. in cooperation with the team of the Ultrasound Technology Laboratory of the Chair of Acoustics and Multimedia at the Faculty of Electronics in Wroclaw University of Technology. The instrument uses an innovative combination of the ultrasound transmission tomography (UTT) method and the ultrasound reflection tomography (URT) method. The ultrasound echography (US) with omni-directional scanning in

several different modes will be added in the prototype. It is possible to obtain 3-D images in these methods, in a similar manner as in the standard computerized tomography (CT). The great advantage of these methods is not exposing the patient to an ionizing radiation. Compared to the conventional breast ultrasound, UTT and URT methods allow for a much larger amount of the information, the clinical significance of which has not yet been well documented. Ultrasound transmission tomography images of studied structures and images of the breast tissue differentiate heterogeneities in relation to their surrounding in the quantitative manner with a good contrast resolution and blurry boundaries, allowing primarily on their characterization. Ultrasound reflection tomography images visualize studied structures with a good spatial resolution, allowing, in turn, to estimate sizes of heterogeneities due to sharpen boundaries. Based on the preliminary obtained results it is expected that the developed device may contribute to create a new standard of the diagnostics and treatment of breast cancer. Ultrasonic tomography device model is currently the subject of efforts of DRAMIŃSKI S.A. (joint stock company) to ensure the implementation on the Polish market under the application framework of the project to the National Research and Development Center (NCBiR).

⋆ ⋆ ⋆

Doppler Multistatic System for Moving Target Detection and Tracking in Water

Ostrowski Zawisza

Department of Marine Electronic Systems,
Faculty of Electronics, Telecommunications, and Informatics,
Gdansk University of Technology
Narutowicza 11/12, 80-233 Gdańsk, Poland

The article presents a Doppler multistatic system designed to determine the position and speed of a moving target in water. Two transmitters are the sources of the signals and they emit sinusoidal, acoustic and continuous waves. Signals reflected off a moving target are received by four hydrophones. The theoretical analysis and the results of numerical calculations of the Doppler effect that occurs in a system are presented, as well as the solution to major constructional problems associated with the use of a continuous wave. Appropriate design of the receiver provides frequency conversion of the received signals as quadrature homodyne multiplication. Then it is possible to distinguish Doppler shifts included in the received signals by suppression of the direct signals. Eight Doppler shifts are determined and inserted into two independent sets of equations. The solution gives instantaneous target coordinates and the vector of target speed. Analytical formulas which describe the spectra of the Doppler shift of echo signals in a multistatic system are given. Spectral lines are assigned to instantaneous target positions. This provides the basis for solving the above sets of equations and the functioning of the system.

⋆ ⋆ ⋆

Standing Waves in the Exponentially Stratified Fluid

Perelomova Anna

Gdansk University of Technology
Narutowicza 11/12, 80-233 Gdańsk, Poland

Standing linear acoustic waves in a resonator which contains an ideal gas which is affected by a force of constant mass density are considered. The temperature of a gas is constant, but its unperturbed density and pressure are exponential functions of coordinate. The analysis starts from the definition of relations of perturbations correspondent to standing acoustic waves. The positions of the nodes and antinodes of acoustic pressure and velocity in a standing wave are evaluated. They differ from that in a homogeneous fluid.

⋆ ⋆ ⋆

Analysis of the Sound Field Diffusiveness in the Reverberation Room

Pilch Adam, Rubacha Jarosław,
Baruch Katarzyna, Kamisiński Tadeusz

Department of Mechanics and Vibroacoustic,
Faculty of Mechanical Engineering and Robotic,
AGH University of Science and Technology
Mickiewicza 30, 30-059 Kraków, Poland

Diffuse sound field is one of the most important assumptions of statistical acoustics. Only in perfect diffuse sound field Sabine's equation for reverberation time is reliable. In sound absorption and sound scattering coefficients measurements, measured in reverberation room it is assumed, that sound field inside is perfectly diffuse. Non-uniformity of the sound field could results in big error and standard deviation in reverberation time measurements. In paper, parameters describing diffusiveness of the sound field are defined and their quantities for selected reverberation rooms are presented. Connection between measurement errors and homogeneity of the sound field is shown. Presented research allows us to formulate requirements in reverberation rooms' qualification procedure, and to choose proper number and positions of receivers in order to obtain the highest reliability of the results.

⋆ ⋆ ⋆

Technique to Seamlessly Connect Sound Samples in Sampling Synthesis

Pluta Marek, Delekta Rafał

Academy of Music
Św. Tomasza 43, 31-027 Kraków, Poland

The paper presents a technique to seamlessly connect sound samples of wind instruments in order to obtain smooth and natural melodic line in a modification of sampling synthesis. The method uses sampling in a non traditional way. The set of samples does not consist of individual pitches. Larger structures, such as intervals or tetrachords, are used instead. Decision-making algorithms and signal processing are applied to create melodic figures by choosing, modifying, and seamlessly connecting fragments of prepared samples, with natural note transitions left intact. Initial listening tests were conducted to determine a set of parameters that produces the most realistic results. Findings of those tests are presented in the paper.

⋆ ⋆ ⋆

An Influence of the Impedance Boundary Conditions on the Indoor Acoustic Field Analyzing via MLM

Prędka Edyta

Acoustics Laboratory,
Faculty of Electrical and Computer Engineering,
Rzeszow University of Technology
Powstańców Warszawy 12, 35-959 Rzeszów, Poland

The study examines an influence of impedance boundary conditions on the indoor acoustic field. For simplicity one considers a representative, rectangular cross-section of the room. On two opposite walls, one assumes the impedance boundary conditions and on the next two ones, the combination of the other two conditions: the impedance and Neumann's. Wall impedance is expressed through the sound absorption coefficient. Acoustic field is analyzed in full range of this coefficient. As an analysis tool, the meshless method (MLM) is used to the classic formulated boundary problem. It is the numerical wave method, domain-boundary one and it does not require of the discretization neither domain nor boundary. Expected results are obtained: the average sound pressure level in the area decreases with increasing sound absorption coefficient, and also near the

impedance walls, it is also decrease with increasing sound absorption. Hence it follows that MLM correctly describes the acoustic boundary problem.

⋆ ⋆ ⋆

Probability Distributions of Long-Terms Noise Indicators in Acoustic Continuous Monitoring of Road Traffic

Przysucha Bartosz[1], Batko Wojciech[2], Pawlik Paweł[2], Szeląg Agata[3]

[1] Department of Quantitative Methods in Management, Faculty of Management, Lublin University of Technology Nadbystrzycka 38, 20-816 Lublin, Poland

[2]Department of Mechanics and Vibroacoustic, Faculty of Mechanical Engineering and Robotic, AGH University of Science and Technology Mickiewicza 30, 30-059 Kraków, Poland

[3]Institute of Structural Mechanics, Faculty of Civil Engineering, Cracow University of Technology Warszawska 24, 31-155 Kraków, Poland

For technical and economical reasons, most often the process of long-term indicators determining in traffic road is based on incomplete measurement sample. In literature there is no methodology of selecting the sample for annual noise indicators. The European Union Directive no 2002/49/EC only specifies that measurement sample should be representative. An incorrect choice of measurement sample as well as improper assumption about its probabilistic characteristic may result in erroneous decisions in the management of environmental protection against noise. Therefore, it is essential to determine the probabilistic characteristics of random samples (the selection of a random measurement sample meets the requirement of representativeness). This will allow to estimate correctly the uncertainty of noise indicators. The paper contains the analysis of a wide research material, i.e. from the 10-year continuous noise traffic monitoring period in the city of Krakow. There were studied the annual probability distributions of noise indicators L_{dwn}, L_d, L_w, L_n and their probability distributions calculated from small measurement samples.

⋆ ⋆ ⋆

Relationship between the Sound of Speech and Music in a Song Cycle by Baird to the Words by Iwaszkiewicz

Radion Ewelina[1], Czyż Henryka[2]

[1]Zygmunt Mycielski Society in Wiśniowa 38-124 Wiśniowa, Poland

[2]Department of Physics and Medical Engineering, Faculty of Mathematics and Applied Physics, Rzeszow University of Technology Powstańców Warszawy 6, 35-959 Rzeszów, Poland

The work describes an analysis of relationships between a tone of music and sounds of speech, which exist in vocal-instrumental pieces. On the basis of a song cycle *Głosy z oddali* (1981) by Tadeusz Baird (1928-1981), composed to the words by Jarosław Iwaszkiewicz (1894–1980), it was shown that lyrics of a piece are subordinate to an original idea of a composer, which manifested itself in the music sphere. The cycle consists of the following songs: *Nad wieczornym jeziorem stoję* (a fragment of the poem *Rachunek*), *Noc* (a fragment of the poem *Appasionata*), *W kościele* (a fragment of the poem *W kościele*). The poems chosen by Baird, before they became a non-musical part of a song, were substantially modified: shortened and adapted to his concrete needs and expectations. Thanks to this, the lyrics are still significant; their sounds are closely interrelated with the tone of music. In order to render the sound and meaning of the words, the composer used sublime illustrative effects.

⋆ ⋆ ⋆

The Primacy of Lyrics over Music in a Song Cycle by Mycielski to the Words by Iwaszkiewicz

Radion Ewelina[1], Czyż Henryka[2]

[1]Zygmunt Mycielski Society in Wiśniowa 38-124 Wiśniowa, Poland

[2]Department of Physics and Medical Engineering, Faculty of Mathematics and Applied Physics, Rzeszow University of Technology Powstańców Warszawy 6, 35-959 Rzeszów, Poland

In the work the primacy of lyrics over music in a vocal-instrumental piece was presented. On the basis of a song cycle *Krągły rok* (1965) by Zygmunt Mycielski (1907–1987), composed to the poems by Jarosław Iwaszkiewicz (1894-1980), it was pointed out that lyrics are inspiration for seeking the right musical means. The cycle consists of the pieces: *Status creaturae*, *Principium individuationis*, *Wilk*, *Cierpieć nie mogę*, *Widzisz, że świta*, *L'Alba* (from the collection of poems *Krągły rok*). The sound formation of poems (sound instrumentation, intonation, vowel patterns) influences the form of the tone of songs. The selection of means used, e.g., consonance chords, variational techniques or literal illustrative music, is dictated by the relationship between the lyrics and music.

⋆ ⋆ ⋆

Infrasonic Noise and Mechanical Vibration Effect on Psychophysical Performance of Drivers – a Pilot Study

Radosz Jan

Central Institute for Labour Protection – National Research Institute (CIOP – PIB) Czerniakowska 16, 00-701 Warszawa, Poland

The literature shows that infrasonic noise in road vehicles often exceeds the admissible values due to annoyance. In the case of mechanical vibrations occupational risk is assessed as average. Although these factors do not exceed values which can be harmful, they can cause annoyance in the working environment and influence the psychophysical functions. Pilot study involved a group of 10 drivers with varying age and experience in driving. The study was conducted in laboratory conditions. Infrasonic noise and mechanical vibrations was recreated from measurements at drivers' workplaces. The aim of the pilot study was to verify the test method for different conditions of exposure to physical agents. The paper presents the results of six tests evaluating psychomotor performance in the field of psychometrics and cognitive processes (evaluating the reaction time, attention and concentration, and anticipation of movement) in relation to the features considered essential for safe driving.

⋆ ⋆ ⋆

Analysis of an Angle of Incidence of Acoustic Wave on Audience Surface in a Concert Hall and in Reverberation Room

Rubacha Jarosław, Flach Artur, Brawata Krzysztof, Binek Wojciech

Department of Mechanics and Vibroacoustics, Faculty of Mechanical Engineering and Robotics, AGH University of Science and Technology Al. Mickiewicza 30, 30-059 Kraków, Poland

While determining sound absorption coefficient in diffuse field conditions, it is assumed that incidence angle distribution

of acoustic wave on analysed surface is uniform. However, conducted experiments showed that incidence angle distribution of acoustic wave on analysed surface in reverberation chamber is not uniform and it changes for different chambers. This has a significant impact on value of sound absorption coefficient determined in different rooms. Measurements of sound absorption coefficient of the audience also revealed that significant differences occur between values measured in laboratory and in situ conditions. In this paper analysis of incident angel direction of acoustic wave on audience surface were carried out. Incidence angle distribution of acoustic wave was determined in reverberation room as well as in concert hall. For obtained distributions, detailed analysis was conducted and sound absorption coefficients of the audience were determined.

⋆ ⋆ ⋆

Determination of the Maximum Noise Level of F-16 Aircrafts Based on the Exposure Levels

Rudno-Rudziński Krzysztof

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

Two noise indices of F-16 aircraft have been recorded in one-second intervals around the military air-field in Lask: the maximum sound level with time weighting $FL_{AF\max}$ and the RMS level L_{Aeq}. In 7 one-day sessions 521 noise events have been recorded in 28 locations. It was found that $L_{AF\max}$ of a sound event can be determined by adding 2.5 dB to the maximum value of L_{Aeq}, 1 s. Ollerhead formula $L_{AE} = 0.81 \cdot L_{A\max} - 23.9$ underestimates the exposure level for large values of $L_{A\max}$ by about 3 dB. For practical applications it is important to estimate $L_{A\max}$ at given location based on measurements of L_{AE}. Four estimators of L_{AE} have been examined. It was found that the estimator $L_{AF\max}* = L_{AE} - 6.67$ gives the smallest range of difference between the measured values and the estimator. This range was equal to 5.0 dB. In the case of linear regression the range was 5.2 dB, and for the inverted Ollerhead formula the range was equal 6.6 dB.

⋆ ⋆ ⋆

Active Vibration Control of Circular Plate Using PowerDAQ Platform and Smart Materials

Sierżęga Mariusz, Leniowska Lucyna

Depertment of Mechatronics and Automation,
Faculty of Mathematics and Natural Sciences,
Rzeszow University of Technology
Pigonia 1, 35-310 Rzeszów, Poland

The article concerns the problem of searching the effective controller design method to suppress the vibration of circular plate and accompanying noise. The paper presents active vibration reduction system, in which the MFC components (sensors and actuators) of different shapes are bonded. SISO type control algorithm has been implemented on the PowerDAQ real-time platform with the use xPC Target tools and Matlab environment. The identification of the object for two actuators MFC was performed and the resulting models in the form of 9 order transfer functions were used to design the digital controller with the use the pole placement method. The controller was first tested in simulations and then implemented on the physical stand equipped with a data acquisition card and industrial computer cooperating with the xPC Target. The correctness and effectiveness of the regulator has been verified using different measuring techniques, including scanning vibrometer. The used real-time controller has suppressed plate's vibration as well as corresponding noise satisfactorily.

⋆ ⋆ ⋆

Single Mode Directivity Characteristics of the Multimode Sound Wave Radiated from Unflanged Cylindrical Duct – Theory and Experiment

Snakowska Anna, Jurkiewicz Jerzy, Gorazd Łukasz

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The paper presents theoretical predictions and experimental results of the acoustic pressure directivity characteristics of a single user-selected Bessel mode for the values of the reduced frequency (Helmholtz number) *ka* allowing for propagation of a multimode wave. The task can be achieved by producing a single mode by means of a mode synthetiser or by means of the mode decomposition method resulting in deriving the consecutive modes amplitudes. The modes amplitudes can be calculated by solving the inverse problem by means of the least square method or by applying the Lommel-Fourier transform to the data of the acoustic pressure measured on a duct cross section. The modes amplitudes obtained in the second method ensure the best approximation of the power transmitted by the multimode wave along the duct. The advantage of comparing the measuring results with the theoretical predictions for the far field radiation is valuable for at least two reasons. The first is that the derivation of the single mode directivity characteristics allows to shape the acoustic field by producing a multimodal wave with prescribed modal content, the second is that it makes possible to select modes which strongly contribute to radiation in a chosen directions and to take, if convenient, steps to diminish this radiation by weakening excitation of these modes.

⋆ ⋆ ⋆

Bayesian Confidence Intervals for the Long-Term Noise Indicators

Stępień Bartłomiej

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The long-term policy of the environment protection against noise in the European Union countries requires knowledge of the values of long-term noise indicators. With their values is associated plan to prevent and reduce the harmful effects of noise in the environmental. These indicators characterize the acoustic climate in the long term. Most often it is assumed that this is the year, so their values are the result of many factors. Estimation of long-term noise hazards indicators requires an access to the results of the whole year sound level monitoring. In practice, is not possible to meet such a requirement. Therefore estimations of indicators are usually done on the basis of the highly limited random sample. They are obtained as results of environmental sampling inspections. Sample size n is very small and range from few to several elements. A point estimation of noise indicators was currently made. It should be noted that the probability of point estimation of parameter will be equal to the real value of the estimated parameter is close to zero. Revaluation or underestimation of noise indicators causes definite social and financial consequences. For this reason, the author indicated the necessity of implementation of non-classic statistic solutions. There was formulated the estimation idea of seeking confidence intervals of expected value of long-term noise indicators by the Bayesian inference method. There was presented theoretical basis of the proposed method, and the example of calculation process which make possible determining searching confidence intervals of expected value of long-term noise indicators L_{DEN} and L_N. The illustration for indicated solutions and usefulness analysis were constant monitoring results of traffic noise, recorded in 2009 on one of the main arteries of Krakow, Poland.

⋆ ⋆ ⋆

The Influence of Aerodynamic Interference of Noise Barriers with Neighboring Objects on Nearby Building Constructions as well as on Pedestrians Acoustic and Wind Comfort

Szeląg Agata

Institute of Structural Mechanics,
Faculty of Civil Engineering,
Cracow University of Technology
Warszawska 24, 31-155 Kraków, Poland

Noise is one of the largest pollution of modern cities. The fight against noise in cities was launched by the legal regulations. Such legislation has led to build sound barriers that could provide the required acoustic conditions near the street. As a result, many new roads are equipped with noise barriers. When designing such elements all the attention is paid to their acoustic and mechanical parameters. However, the influence of aerodynamic interference of noise barriers with neighboring objects on nearby building constructions as well as on pedestrians acoustic and wind comfort is not taken into account. The effect of such negligence might be very significant, i.e. exceeding the permissible standards for pedestrian comfort, excessive noise caused by aerodynamic interactions or even damage to neighboring buildings. The paper presents preliminary studies aimed at defining the design guidelines for noise barriers taking into account the influence of interference.

⋆ ⋆ ⋆

The Influence of Audio-Visual Interactions on Wind Turbines Annoyance Ratings

Szychowska Malina

Institute of Acoustics, Faculty of Physics,
Adam Mickiewicz University
Umultowska 85, 61-614 Poznań, Poland

The aim of this paper is to investigate the influence of audio-visual interactions on wind turbines annoyance ratings in experimental conditions, preserving the impression of real-life situation. The study was conducted in an anechoic chamber adapted for an ambisonic auditory presentation, and high-quality visual presentation. 44 participants rated: annoyance of audio samples (part 1), pleasantness of video samples (part 2), and annoyance of incongruent and congruent audio-video samples. After part 1, participants were also asked to identify the sound sources. Hypotheses were as follow: wind turbines recognition increases the annoyance ratings, presence of wind turbines, in audio or visual samples, increases the annoyance ratings. Results suggest that wind turbines recognition increase the ratings, however a systematic error might be biasing this effect – people who recognized wind turbines rated all wind turbines and transportation noise higher. Results of audio-visual part showed that large wind turbines in visual sample always increased the annoyance ratings. Small wind turbines increased the ratings when presented along with audio samples at sound level of 65 dB, and decrease the annoyance ratings for lower sound levels.

⋆ ⋆ ⋆

The Computer Model of Ultrasonic Doppler Tomography for Circular Geometry

Świetlik Tomasz, Opieliński Krzysztof J.

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

Ultrasonic techniques are currently being intensively developed as the methods of tomographic imaging of tissues *in vivo*. One of such modern methods is the Doppler Tomography (DT), also called Continuous Wave Ultrasound Tomography (CWUT). This method significantly differs from the classical Doppler imaging of blood flow because in this case, the Doppler effect, which is generated as the result of the movement of the two-transducer transceiver ultrasonic array around or along an object immersed in water, is used for the imaging of scattering properties in a fixed structure of its cross-section. Currently, there are no comprehensive studies on the Doppler tomography in the literature, and in particular, there are no simulations and measurements of the structure of biological media, which would allow the analysis of applicability of this method in medical diagnostics. This paper shows the simulation method of tomographic measurements of amplitudes in separated Doppler frequency spectrum bands, for the specified sections of objects of a structure which scatters ultrasonic waves, using circular scanning geometry. The algorithm of filtered back projection (FBP) used in X-ray tomography has been adapted for the reconstruction of tomographic Doppler images. The computer model of ultrasonic Doppler tomography thus developed enables the testing and optimization of parameters of the image reconstruction algorithm, as well as studying the effect of scan parameters (e.g. rotational speed, location of scatters relative to the rotation center) on the quality and accuracy of imaging. Based on the results obtained, it is expected that the Doppler tomography can be effectively used in medical diagnostics for imaging of soft tissue structures in order to detect neoplastic lesions, e.g. in female breast, or to test limb bones.

⋆ ⋆ ⋆

Test Stand for Research about the Impact of the Guitar Elements on Its Tone

Tokarczyk Daniel

AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The sound resonated from the guitar is influenced by many factors like: materials the guitar is made of, bridge type, size of the instrument, tension and type of strings. The musician's way of playing also has a strong impact on the tone: position, angle and value of the force applied to pluck the strings are crucial. Furthermore, the arrangement of fingers that hold strings to the guitar neck is also an important factor. Musicians have argued for a long time about how those factors affect the guitar tone. The conclusions are subjective as it is impossible for a human being to achieve necessary repeatability of guitar play. Samples obtained from human play can differ significantly from each other, making it impossible to clearly determine the impact of the guitar parts on its tone. This article presents the operation method and the application of a test stand designed to perform research how the guitar components affect its tone. It has been created based on a programmable, modular guitar playing robot. The main goal of creating the test stand was to improve the research on how guitar components affect its sound. By using the robot for playing note sequences repeatability, far exceeding human capabilities, was achieved. Therefore, it was possible to gather comparable sound samples for multiple guitar element combinations. Sample analysis was performed by comparing the peak values of the spectra obtained from the fast Fourier transform.

⋆ ⋆ ⋆

Improvement of the Recorded Violin Sound with using Digital Signal Processing

Viarbitskaya Tatsiana, Dobrucki Andrzej

Chair of Acoustics and Multimedia, Faculty of Electronics,
Wroclaw University of Technology
Wyb. Wyspiańskiego 27, 50-370 Wrocław, Poland

The topic of sound quality of violin playing is still on the top of the research. The paper shows how using algorithms of the signal processing it is possible to obtain the higher quality of the recorded sound. The paper presents the properties of sound emitted by the violins with different playing techniques. The sounds of Luthier's violins are compared with the sounds

of mass produced ones. Using the signal processing algorithms it is possible to improve the sound of mass produced violins and make it closer to the sound of Luthier's violins. The deciding role plays the choice of the time window. It can be different for various playing techniques. The best choice of time window for each playing technique is discussed in the paper.

⋆ ⋆ ⋆

Noise on Selected Workstations on Shale Gas Rigs during Milling Operations

Warmiak Izabela, Mikulski Witold

Central Institute for Labour Protection
– National Research Institute (CIOP – PIB)
Czerniakowska 16, 00-701 Warszawa, Poland

Noise on workstations at gas and oil boreholes is characterized by big variability of sound pressure level in time. This variability results from different operations at boreholes (deepening of borehole, releasing and drawing of drill pipes, milling, fracturing etc.) and the fact that workers work at different place, where the sound pressure level is not the same. One of typical operations is milling the borehole. It is rarely conducted, however considering the necessity of ensuring more caution than during other operations, it's conducting requires more time, which depending on depth and compositions of the soil could be much longer than 12 hours work shift. Results of measurements and noise exposure assessment on workstations during milling operations are shown in the article. Standard 12 hours work shift during 14 days (next 14 days are off-duty) for worker on shale gas was used for assessment. Rating was conducted on three workstations, on which noise level is the biggest i.e. workstations of: driller, tower driller assistant and hole driller assistant. Results of rating proved occurring noises exceeding permissible levels of noise for hearing protection.

⋆ ⋆ ⋆

Acoustic Vortex Flows from Experimental Studies

Weyna Stefan

West Pomerania University of Technology
Al. Piastów 17, 70-310 Szczecin, Poland

One of the important effects of aerodynamic flow is generated sound that achieving high amplitude becomes burdensome to the environment noise. The source of the noise is disordered nature of the flow produced at different geometrical structures introduced in the flow field. Caused for the trailing edges and leading to abrupt discontinuities and structure of the aerodynamic effects in the form eddies and turbulence associated unambiguously with the birth of sound and research of these phenomena in contemporary sound theory is a new "theory of vortex flows" (Sound Vortex Theory). For the creators of this theory, it is believed A. Powell, M.E. Goldstein and M.S. Howe who are developing analog mechano-acoustic the Laighthill model and using numerical models of the CAA, made the old concept of "flow sound" becomes a new, rapidly growing, acoustic issues closely related to fluid mechanics. The article is elementary introduction to these issues and the results of their own research, an attempt to associate acoustic images of disturbed flow with the theory of vortex flows. Numerous examples will be presented of turbulent reacting flows in the area of wave obstacles.

⋆ ⋆ ⋆

Soundscape of Krakow and Małopolska Region

Wiciak Jerzy

Department of Mechanics and Vibroacoustic,
Faculty of Mechanical Engineering and Robotic,
AGH University of Science and Technology
Mickiewicza 30, 30-059 Kraków, Poland

Research associated with the soundscape planning of public spaces were developed over the last decade. In noise control, noise is a waste product managed to reduce the immision of sounds that cause human discomfort. Soundscape approach, by contrast, requires knowledge on how the soundscape of a place is evoked by its sonic environment, given visual, cultural, and situational contexts. The paper starts with presentation of soundscape types, indicators, and methodological issues. The paper presents the research results and experience carried out in Malopolska region and Krakow urban area. Among others, the paper presents research results conducted in the area of the Niepolomice Forest, conserved and protected by the European Eco logical Network Nature 2000.

⋆ ⋆ ⋆

Experimental Validation of the Viola da Gamba the Finite Element Model

Wilczyński Tomasz J., Filipek Roman,
Wilczyński Paweł, Kleczkowski Piotr

AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

After the literature review about the bowed and stringed musical instruments, especially regarding to research over the Viola da Gamba, noticable is a lack of scientific knowledge about acoustics of this instrument and its mechanical properties. Accordingly, it was decided to make an investigation over the influence of changes in Viola da Gamba construction parameters on its sound. To achieve this purpose, instrument model validation should be done, what this article includes. Based on results from experimental measurements, and calculations for numerical model, the Modal Assurance Criterion (MAC) has been proposed for a measure of the fit between mode shapes. The numerical model of Viola da Gamba was created by using Finite Element Method (FEM). Essentially, the instrument model is prestressed and takes into account the sound board initial strains induced by displacements related to the soundpost length and traction forces resulting from strings tension. Additionally, the orthotropic material theory of wood has been used. Furthermore, series of experiments were conducted for the identification of model parameters. The main approach of this investigation has been made by Design of Experiment Method (DoE). Finally, based on MAC, a satisfactory match of the mode shapes was achieved.

⋆ ⋆ ⋆

Properties of Amplitudes Distributions of Acoustic Emission Signals Generated within the Pressure Vessel

Witos Franciszek, Olszewska Aneta,
Opilski Zbigniew, Setkiewicz Maciej

Department of Optoelectronics,
Faculty of Electrical Engineering,
Silesian University of Technology
Akademicka 2, 44-100 Gliwice, Poland

This paper presents research results related to measurements of acoustic emission signals properties generated within the tested pressure vessel. The tests were performed by using several times the following procedure: increasing the pressure, maintaining the resulting pressure level, further increasing the pressure and then maintaining the pressure at specified obtained level. During the study, the acoustic emission signals were recorded using authors 8AE-PD measuring system fed by D9241A piezoelectric transducers. Author's eight-channel measurement system used in the study enables the monitoring of signals, registration signals in real time and analysis of the recorded signals. The study of the results with basic and advanced analysis of registered acoustic emission signals, are presented. Within the frame of advanced analysis based on properties of acoustic emission signals amplitudes distributions, results of the analysis are described by descriptors with acronyms ADP, ADC and ADNC. ADP, ADC and ADNC are descriptors defined by au-

thors and they identify signals assigning them the stage of the signals.

⋆ ⋆ ⋆

Subjective Evaluation of Violin Loudness

Wrzeciono Piotr

Warsaw University of Life Science – SGGW
Nowoursynowska 166, 02-787 Warszawa

Violin loudness is an important property of this instrument. A subjective evaluation of it is often made during the violin making competitions. The violin loudness evaluation depends not only on the objective acoustic properties of the instrument, but also on the way of playing. The paper presents an analysis of evaluation of violin loudness made by jurors of the 10^{th} International Henryk Wieniawski Violin Making Competition. The analysis includes statistical research of the subjective evaluations made by jurors and connections between those subjective evaluations and the objective parameters. Additionally, the classifier calculating the subjective evaluation of violin loudness based on objective parameters was developed. The mentioned classifier was obtained by using a genetic algorithm. The calculated evaluations are consistent with the jurors' opinions.

⋆ ⋆ ⋆

Tonal and Impulse Adjustment for Noise Source Rating Levels

Wszołek Tadeusz

Department of Mechanics and Vibroacoustics,
Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

The work concerns the measurement and analysis of environmental noise characteristic features for the application of pulsed and tonal correction within the meaning of ISO standard in the series 1996. The algorithms for tonality classification, based on the psychoacoustic concept of critical bands quite well developed and verified in terms of subjective feelings. The problem is, however, to measure the tonality in continuous monitoring with control and automatic classification of the tonality and applied the adequate correction. A much more difficult task, however, reveals the classification of individual pulses and their qualification at all. In this area have not yet algorithms that would enable to classify them and use a proper correction. The paper presents the results of impulse and tonal noise with an extraction of the characteristic features to their differentiation in terms of environmental nuisance. It has been pointed out the main difficulties in their assessment and final qualification for the application of correction.

⋆ ⋆ ⋆

Statistical Analysis of an Influence of the Active Measurement Volume on Obtained Sound Absorption Coefficient Values

Zastawnik Marcin[1], Kiełbasa Jadwiga[1], Szeląg Agata[2], Kamisiński Tadeusz[1]

[1]Faculty of Mechanical Engineering and Robotics,
AGH University of Science and Technology
Al. Mickiewicza 30, 30-059 Kraków, Poland

[2]Institute of Structural Mechanics,
Faculty of Civil Engineering,
Cracow University of Technology
Warszawska 24, 31-155 Kraków, Poland

During the measurements of sound absorption coefficient in a reverberation chamber, the common problem is getting the value of this parameter above unity, which is contrary to physics of absorption phenomena. A basic reason for this paradox is considered to edge effect, but the studies also point to other sources of such an error. The aim of this study was to investigate the effect of reverberation chamber volume on obtaining in the measurements sound absorption coefficients. For this purpose there was build a special measuring stand. Then, there was performed a series of measurements for the different samples in terms of their absorption properties and geometry as well as for different volumes of reverberation chamber. The key point of the research was to conduct a statistical analysis of obtained data and based on its results to determine the influence of each variable on the obtained values of sound absorption coefficient.

⋆ ⋆ ⋆