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Chronicle

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The Open Seminar on Acoustics is an annual conference, the largest acoustics conference in the country. It has been bringing all Polish acousticians together for over sixty years. It is organized in turns by different divisions of Polish Acoustical Society – in 2019 by the Poznań Division with the Institute of Acoustics, Adam Mickiewicz University in Poznan and Committee on Acoustics of Polish Academy of Science. The conference presents all sections of acoustics, such as: physical acoustics, technical, environmental, speech, hearing, musical, architectural acoustics, etc. The seminar is joined with special session "New trends in psychoacoustics in tribute to professors: Józef Zwisłocki and Andrzej Rakowski" and the Workshop "Noise protection in regulations – current state and directions of changes" (in Polish). We also invite you to the special session "Advances in research in the field of audio acoustics and sound engineering – ISSET 2019".

Abstracts

A computer model for calculating the speech transmission index using the direct STIPA method

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Computer models currently used for the simulation of the speech transmission index (STI) calculate the STI using the statistical method or are based on numerically determined impulse response of the transmission channel. The limitation of both these computational methods is that they do not allow to take into account the non-linear properties of the transmission channel and fluctuating background noise. This paper presents a proposition of MISO (Multiple Input Single Output) model based on the direct method of STIPA. This model allows to computer simulations of STIPA for distributed sound systems, and enables analysis to include both changes in signal dynamics and fluctuating background noise. The work presents the idea of the model and validation of its basic elements – the generator and the analyser. The possibilities of using the model for computer simulation of outdoor public address systems were also discussed.

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A prototype of Chinese aspirated consonants pronunciation training system based on multi-resolution cochleagram

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Mandarin Chinese is considered to be one of the most difficult languages to learn, mostly because of its phonological and tonal systems. Since pronunciation training during formal classes is limited, learners need an alternative which will help them practice pronunciation without teacher's assistance. The solution are computer-assisted pronunciation training (CAPT) systems. I introduce a prototype of CAPT system focusing on pronunciation errors related to aspiration: deaspiration of aspirated consonants and aspiration of voiceless not aspirated consonants. The system incorporates multi-resolution cochleagram (MRCG), a psychoacoustic model of basilar membrane excitation pattern. Mispronounced phonemes detection is performed by recurrent neural network (RNN) trained using MRCG features. Proposed system achieves 96,12% accuracy rate in pronunciation errors detection and 98,58% accuracy rate in determining aspiration length. It may be particularly useful for native speakers of languages in which aspiration does not exist or is non-distinctive feature, e.g. Slavic and Romance languages.

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Advanced methods of breast tissue ultrasound tomography imaging

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Breast cancer is the most common cancer among women. Imaging of breast lesions is currently the primary

quality as well as a timbre are dependent on the bit-rate. The additional conclusion is that the CCR method is more accurate for sound assessment for higher bit-rate values and this fact has been verified by standard deviation values of obtained results. The speech signals were additionally examined with PESQ method. The results have shown that the assumed quality of 4 MOS for speech could be achieved at 48 kbit/s. This fact was confirmed by both: subjective and objective research.

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Optimization based validation of room acoustic models

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Results obtained in a numerical modeling are biased with reasonable errors, which are connected mainly with the simplifications of both: modeled physics phenomenon and geometry of modeled object. Not precise material parameters are also a source of uncertainty of results. Reduction of uncertainty of results is possible in cases, when there is a physical representation of object at least similar to a modeled one. Validation of a numerical model using measurement results let to choose the best calculation methods and to narrow down the range of input parameters range. Both benefits are important in geometrical acoustics (GA) methods, where a significant error is inherent with the sound absorption coefficients. Errors arise mainly from a different acoustic field both in a laboratory and *in situ* conditions. In the paper, a validation method of a geometrical acoustics model was proposed. The procedure of selection of key simulation parameters was proposed (number of rays and ray tracing time), as well as a range of variation of input parameters and a similarity criterion between a model and a measurements results. Basing on simulation and measurement results of five acoustically different interiors, it was proved, that optimization based material parameters search, let to decrease the difference between model and measurement results by over five times.

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Performance of coherent modulation scheme used in acoustic underwater communication system

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The development of an acoustic underwater communication system for shallow waters is still a big scientific and construction challenge. Currently, non-coherent modulations in combination with strong channel coding are used to achieve reliable communication with low rate in such a channel. To obtain transmission with a higher transmission rate, it is required to use coherent modulation. This paper presents the assumptions of such a transmission system and the results of data transmission carried out by this system in the channel with the Rician and Rayleigh fading. A digital version of the carrier phase modulation known as Phase-Shift Keying was selected for simulation. In addition, the idea of improving the transmission quality based on the channel equalizer was included.

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Prediction of acoustic parameters in orchestra pit based on Barron and Lee revised theory

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Musicians in the orchestra pit often report problems with too high sound levels during performances. At the same time, numerous surveys indicate frequent problems with the mutual hearing of musicians with each other, as well as themselves or a singer from the stage. The structure of the orchestra pit causes the musicians to be exposed to strong reflections with low delay, which increases the overall sound pressure level. In the literature, one can find recommendations that the space of the orchestra pit should be treated with sound absorbing materials in a wide range and with sound-scattering materials without indicating their quantity or localization.

This paper focuses on the development of tools for assessing and predicting the value of energetic parameters such as sound strength G or clarity C80 in the orchestra pit based on its acoustic absorption and the volume of the hall. The sound propagation model in concert halls proposed by Barron and Lee was adapted for this purpose. The sound strength G can be used to predict the acoustic conditions in the orchestra pit, such as the sound pressure level, the mutual audibility of the musicians, and how the room supports playing musicians. The analysis covers several existing halls of different geometry and size, as well as the design of the barrier of the orchestra pit with the proposed modifications.

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Prediction of low-frequency sound field in rooms with complex-valued boundary conditions on walls

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A modal representation of a room impulse response has been used to formulate expressions for low-frequency sound field in rooms of arbitrary shape. Based on theoretical results, a simulation program has been developed to predict a sound pressure distribution and a room transfer function inside rectangular enclosure having walls covered by a material of complex impedance. Damping properties of the material have been described by the random-incident absorption coefficient. Calculation results have shown that a wall reactance strongly influences a sound absorption inside a room and an increase in the absolute value of the reactance leads to a drop of a sound attenuation. Furthermore, it was found that changes in the wall reactance entail

a substantial modification of a sound pressure distribution. Finally, an influence of wall reactance on the room transfer function was investigated and it was discovered that a change in a reactance sign causes a shift in frequencies of modal vibrations excited in the room.

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Problem of placing the organ pipes on the windchest

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This paper presents research showing the problem occurring in the construction of a pipe organ, related to the placement of the organ pipes on the windchest. The close location of the organ pipes to each other influences the parameters of the sound generated by the pipes. It causes an intonation problem, namely the detuning of the organ pipes if they are located too close to each other on the windchest. The presented measurements show the influence of a distance between pipes of various types on basic sound parameters, such as frequency or volume level. The research carried out shows that in extreme cases the detuning reaches a temperate halftone. This has undoubtedly an impact on the tuning of organ pipes, especially in the case of a table organ or pipe organ built in a small space. In the future, the outcomes of the presented research can be applied in the windchest design.

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Program loudness on different media type

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The paper presents a comparison of the values of acoustic parameters related to the program loudness of broadcasting program distributed on various media type. The purpose of the work is to observe the acoustic parameters of measured program depending on the type of media. The following parameters were measured: the actual peak TPL (True Peak Level), loudness (in LUFS), RMS value and DR (Dynamic Range). For analysis, program distributed by an analogue media (eg. FM), a digital media (DAB+), and from different internet services (streaming) were used.

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Remembrance about Marianna Sankiewicz and Gustaw Budzyński – our teachers and scientific mentors

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Doc. Dr. Eng. Marianna Sankiewicz-Budzyńska (who passed away on 29 May 2018) was a co-organizer of the Laboratory of Electrophone and Sound Engineering at Gdansk University of Technology, author and co-author of over 130 scientific publications, supervisor of numerous master and doctoral theses in the field of studio techniques in radio and television. She had an outstanding contribution to the development of sound recording technologies and their practical use in Polish Radio.

Doc. Dr. Eng. G.K.E. Budzyński (who passed away on 29 July 2018), half a century earlier, in 1968, together with his wife and research associate, Doc. dr inż. Marianna Sankiewicz-Budzyńska founded the Electrophone Laboratory, which was part of the Telecommunications Institute. In 1982, he took over the management of this laboratory, and at the same time changed its name to the Department of Sound Engineering. Doc. Budzyński chaired this department for nine consecutive years, creating the program of the first in the country and for many years the only specialty under the name Sound Engineering.

Their achievements have been repeatedly presented at scientific conferences in Poland and abroad, including many editions of Open Seminar on Acoustics. In the domestic and foreign academic centers (Gdańsk, Wrocław, Kraków, Thessaloniki, St. Petersburg, Aalborg), the research and didactic program initiated by them are still in use in a regularly updated form.

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Required attenuation of aircraft noise in buildings in the light of data from the Chopin Airport monitoring

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The minimum attenuations of aircraft noise required by the Polish Standards concerning acoustic insulation and noise levels inside buildings have been compared. Data from the noise monitoring system of the Chopin Airport were used.

The minimum attenuation required by PN-B-02151-02: 1987 differs from that required by PN-B-02151-3: 2015-10. The highest required attenuation occurs when taking into account the maximum sound level $L_{A\max}$ of aircraft noise. The requirements related to $L_{A\max}$ are 2.0 to 7.8 dB higher than those associated with the equivalent sound level L_{Aeq}.

If the flight operations number will approach the maximum number of forty ones at night, the requirements related to L_{Aeq} may be decisive.

The requirements connected with L_{Aeq} according to PN-B-02151-02: 1987 are 0.6 to 2.6 dB higher than coming from PN-B-02151-3: 2015-10.

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Scientific legacy of professor Andrzej Rakowski in current studies of pitch discrimination in music

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