Chronicle

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Open Seminar on Acoustic is an annual conference that brings together researchers and scientists from acoustics. It is organized under the patronage of the Committee on Acoustics of the Polish Academy of Sciences in turns by different divisions of Polish Acoustical Society – in 2022 by the Rzeszów Division of Polish Acoustical Society jointly with the College of Natural Sciences, University of Rzeszów.

It is our pleasure to present abstracts of the papers submitted for the 68th Open Seminar on Acoustics – OSA 2022 – that was held September 12–16, 2022 in the Solina Resort located in the South-East Poland.

Abstracts

Pickering droplets and capsules under magnetic fields – calorimetric and ultrasonic studies

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Nanoparticles and their derivative materials, such as particle-covered droplets (Pickering droplets) or capsules, hold promise to be utilized in biomedicine, for instance, to enable targeted drug release and improve the efficiency of thermal therapies. Using such materials simultaneously with diagnostic modalities (e.g. Magnetic resonance imaging or ultrasound imaging) opens the possibility of the so-called theranostic approach, in which combining multiple modalities into one platform may provide numerous benefits for patients.

Herein, we present the potential use of magnetic fields for future theranostic applications. We investigated the temperature elevation when Pickering droplets were exposed to the alternating or rotating magnetic field. When the temperature exceeded the temperature of glass transition, the thermo-sensitive polymer particles partially sintered and formed a rigid shell around the droplets (colloidal capsules). For testing the behaviour of droplets during magnetic heating, the non-destructive ultrasound measurements were performed and showed no significant difference in acoustic properties after exposition to magnetic fields. In the future, the acoustic method could be also used for evaluation of the efficient capsules formation.

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Leaky partial updates to control a real device casing

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Structural active noise control (ANC) is one of few solutions applicable when global noise reduction is required: control of a whole device casing allows to lower the acoustic energy emitted by this device. Unfortunately, structural ANC usually requires a large number of sensors and actuators, making the control system multichannel with large dimensionality. This in turn presents a huge computational power demands. There are several ways to lower this demand, the partial updates being one of them. The goal of this paper is to show applicability of the leaky partial update LMS algorithms in structural ANC of a washing machine casing. The transfer functions of the numerous device paths were identified using a real washing machine present in the ANC laboratory. The identified transfer functions allowed to create a simulation system, where different algorithms could be easily tested. The results of the simulations confirm effectiveness of the proposed solution.

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Sound source localization – comparison of six popular microphone systems for stereo recordings

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Dating back to the early 30's and the beginning of stereo recording, many sound engineers experimented with different multi-microphone techniques to capture the sound in a way that it would be natural to the human ears when listening. Many different techniques of stereo sound recording have been developed so far. Among them two-microphone techniques AB, XY or ORTF should seem to be the most commonplace ones.

well as with some of the Rossiter modal frequencies, typical for the phenomena occurring in the cavities.

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Numerical reconstruction of Cieszyn flute sound

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The paper presents part of the work on the functional numerical reconstruction of a historic mammoth flute from the collection of the Museum of Cieszyn Silesia. The flute was discovered in 2012 in Cieszyn. When it was found, it was already damaged, Unfortunately it was further deconstructed during conservation. Therefore, reverse engineering techniques had to be used to reconstruct the original shape of the instrument.

The 3D scans and geometric models of the flute were developed at the Faculty of Architecture of the Wrocław University of Science and Technology. They were used for numerical sound reconstruction. The work on the reconstruction consisted of several stages, the most important of which were: determining the characteristics of the excitation and of the flute itself as a resonant system. The first of these stages was carried out using the methods of computational fluid dynamics (CFD) and Curle's aeroacoustic analogy. The second stage was to solve eigenvalue problem using the finite element method The computations allowed to define the musical scale of the instrument.

At the same time, the work carried out at the Faculty of Architecture of the Wrocław University of Technology allowed for the physical reconstruction of the flute in the form of a 3D print. The object reconstructed in this way was used to verify the results obtained numerically.

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Analysis of sound absorption performance of acoustic absorbers made of fibrous materials

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Absorbing properties of multi-layer acoustic absorbers were modelled using the impedance translation theorem and the Garai and Pompoli empirical model, which enables a determination of the characteristic impedance and propagation constant of fibrous sound-absorbing materials. The theoretical model was applied to the computational study of performance of single-layer acoustic absorber backed by a hard wall and the absorber consisting of one layer of absorbing material and an air gap between the rear of the material and a hard back wall. Simulation results have shown that a high thickness of absorbing material may cause wavy changes in the frequency relationship of the normal and random incidence absorption coefficients. It was also found that this effect is particularly noticeable for acoustic absorbers with a large thickness of air gap between the absorbing material and a hard back wall.

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Acoustic indices in the analysis of the soundscape of the Kościeliska Valley in the Tatra National Park – case study

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The development of our civilization and increasing noise pollution are strongly connected. In 2021, the Tatra National Park was visited by a record number of tourists – about 4 million 600 thousand. The previous record was broken in 2018 – then the Polish Tatra Mountains were visited by 3 million 800 thousand. People. The aim of the paper is analysis of noise pollution and soundscape of the most popular national park in Poland – Tatra National Park. The Kościeliska Valley was selected for the study, because it is the second area in the park in terms of the number of tickets sold according to the statistics kept by the Tatra National Park. The paper presents the results of the analysis of acoustic measurements and ambisonic recordings made in four seasons using classical method and the soundscape method. In addition, psychoacoustic parameters and acoustic indices such as: loudness, sharpness, or roughness, ACI (acoustic complexity index), NDSI (normalized difference soundscape index), BI (bioacoustic index), ADI (acoustic diversity index), AEI (acoustic evenness index) were calculated.

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Modelling of an acoustic wave scattering on the aircraft surface using the boundary element method

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Sound localization tools are important in the environmental protection and the human searches. The article is one of the stages of the implementation of the concept of using aircraft to localize sound sources. The use of a fixed-wing aircraft instead of a multirotor would increase the total flight time, and expand the surveyed area. It is important to determine the most favourable positions of the receivers on the surface of the aircraft. The scattering effects of the sound waves coming from the ground source and aircraft engine on the acoustic field on the aircraft surface are not homogeneous. In the article the authors present the modelling of the scattering of the sound waves over the airplane surface with the usage of boundary element methods. After determining the effects from the sound source on earth and from the aircraft engine the conclusion was made, that the influence from the engine noise is greater than that from the ground source, and in order to localize the low amplitude signals, the aircraft need to glide. Considering only the effects of the ground source, the optimal areas for the microphones placement were determined.

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