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Abstracts

Similarities and Differences of Physicochemical Properties of the di- and triacylglycerols under High Pressure Calculated from the Results of Ultrasonic Measurements

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Two samples of triacylglycerols i.e., olive oil and triolein, and one sample of diacylglycerol were investigated. In the course of compression, the density of the samples was determined by measurements of the change of piston position in pressure chamber and volume correction due to chamber expansion under pressure. The speed of sound was calculated from the time of flight of ultrasonic impulse between emitting and receiving transducers placed in the high pressure chamber. The adiabatic compressibility, intermolecular free length, molar volume, van der Waals' constant b and surface tension were calculated from the density, speed of sound and average molecular mass. All tested liquids undergo the high-pressure phase transition. Discontinues of the measured isotherms of the physicochemical parameters of the investigated oils indicate the presence of the high-pressure phase transitions. Moreover the change of pressure during the phase transition was measured. The fundamental difference in molecular structure of these acylglycerols influences significantly on their behavior under high pressure.

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The Simplified Method for Measuring the Improvement of Impact Sound Insulation of Floor Coverings

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Laboratory measurements of reduction of impact sound pressure level according to PN-EN ISO 10140-3 standard are difficult in realization. In order to fulfil basic methodology requirements they are performed using two chambers coupled vertically, which the upper is called source room and the lower – receiving room. These chambers are separated by a 140 mm thick reference floor made of concrete, on which the resilient surfaces are laid. In Poland only one research facility may carry out such measurements. This paper describes preliminary studies which are the basis for design an impact sound reduction test stand based on the devised simplified method. Author using the Statistical Energy Analysis shows that the improvement of impact sound insulation by floor coverings depends primarily on the parameters of the sample. Moreover, during the measurements the type of a chamber plays a secondary role. This thesis was also confirmed by in-situ measurements carried out in two different rooms.

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Model Studies of Sound Absorption Coefficient of Periodic Structures

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Basic theoretical considerations concerning the determination of sound absorption coefficient values assume that for the plane wave incident at an angle θ the reflected wave is also a plane wave reflected specularly. This assumption is true for isotropic, homogeneous and infinitely large planar surfaces. However, for spatial elements or flat surfaces possessing superficial impedance that periodically fluctuates, the reflected wave is a sum of n plane waves reflected at angles θ_n. In this case, the formula for a sound absorption coefficient $\alpha = 1 - |R|^2$, where $|R|$ is the magnitude of reflection coefficient is simplistic. In the paper the authors present a distribution of the sound field in front of different periodical surfaces for a plane wave oblique incidence. It was based on an analytical solution and numerical simulations using finite element method. Furthermore, taking into account the type of reflected waves the values of a sound absorption coefficient for the analysed structures were determined. Presented studies are the basis for mod-

TMC experiments using a standard adaptive method and the new method are comparable (i.e., very highly correlated).

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Localization of Acoustic Sources Using a One-channel Time Reversal Method: a Study with FEM

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This study investigates a problem of an acoustic sources localization inside an acoustic cavity by processing measurement data from a single sensor with the use of time reversal (TR) method. Presented method is based on the principle of time-reversal invariance and spatial reciprocity of the acoustic wave equation in a lossless medium. In a classic experiment, the acoustic waves propagated from a point-like source can be refocused in the original source location if the output measured by a set of transducers is time reversed and re-emitted back. A perfect localization would require an array of sensors totally enclosing the acoustic cavity, which is very difficult to obtain in practice. Sensors are often arranged in a time reversal mirror (TRM) of finite aperture and bandwidth that limits the focusing quality. There are studies showing that reverberations of a diffuse wave field in a complex medium enhance the focusing resolution of the re-emitted signal. This phenomenon, called super-resolution, is mainly due to the presence of scatterers within the medium that allow the evanescent modes (waves that decay exponentially with the distance to the source) to be converted into propagating modes. These waves, carrying the information of the acoustic source to the far field, where the TRM is located, can participate to the focusing process. The result of such operation creates a virtual sound sources and the number of the TRM transducers can be drastically reduced, even to a single transducer. Research is conducted as a FEM modelling for preliminary determination of the capabilities and accuracy of TR method in selected acoustic medium geometry and configurations of the transducer location.

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A Research Study of an Absorbing Structure Dedicated to Anechoic Chambers

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Sound-absorbing structures are the most important elements that form the sound field in anechoic chambers. Depending on the purpose of a chamber, these structures could take various shapes. The most popular are sound-absorbing wedges which specific acoustic properties are achieved based on scientists broad knowledge and research results. Due to modernization of the anechoic chamber placed in Department of Mechanics and Vibroacoustics AGH in Kraków, a series of studies were undertaken in order to develop the best suited sound-absorbing elements. The article presents results and interpretation of studies carried out in the impedance tube which was specially designed and constructed based on the PN-EN ISO 10534-2 standard. The studies allowed to analyze impact of material type, geometry, coverage and mounting on wedge acoustic properties. The selected structures were produced and mounted in the anechoic chamber and tested in accordance with the procedure described in PN-EN ISO 3745 standard.

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Thermocouple Measurement of Temperature Variations in Soft Tissue Phantoms versus Backscattered Ultrasonic Signals Properties

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The aim of the work is to find the relationship between temperature changes in soft tissue phantoms and changes in the envelope of backscattered ultrasound signals. The phantoms were produced from polyvinyl alcohol – cryogel (PVA-c). The different acoustical properties of phantoms result from different number of freeze-thaw cycles. The raw RF signals (radio frequency) were collected from chosen parts of phantoms subjected to heating. The heating of phantoms was carried out in a water bath for 2 h with controlled temperature increase from 20°C to 43°C. The actual temperature distribution during the heating process, in different places of the samples was measured using a thermocouples working in USB-TEMP module. Simultanously, in 5 min intervals RF signals were recorded by a ultrasonic imaging system. The system consisted of the linear imaging ultrasound transducer L14-5/38 and the ULTRASONIX SonixTOUCH (British Columbia, Canada) device. The carried frequency of transmitted signal had 10 MHz and the beam was focused at a depth of 3 cm from the phantom surface. Maps of CBE (changes in the backscattered energy), SNR (signal-to-noise ratio) and shape parameter of the Nakagami distribution, were determined from the amplitude of the RF signals. To calculate these maps the method of "moving window" of size 2×2 mm were applied. The compatibility of changes in these maps with the changes in the spatio-temporal distribution of temperature, registered by a thermocouples was demonstrated.

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Measurement of Insertion Loss of the Acoustic Microperforated Silencer

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Silencers are elements which reduce noise propagating in the duct, e.g. heating, ventilation or air conditioning systems (HVAC). The most commonly used are the absorbent