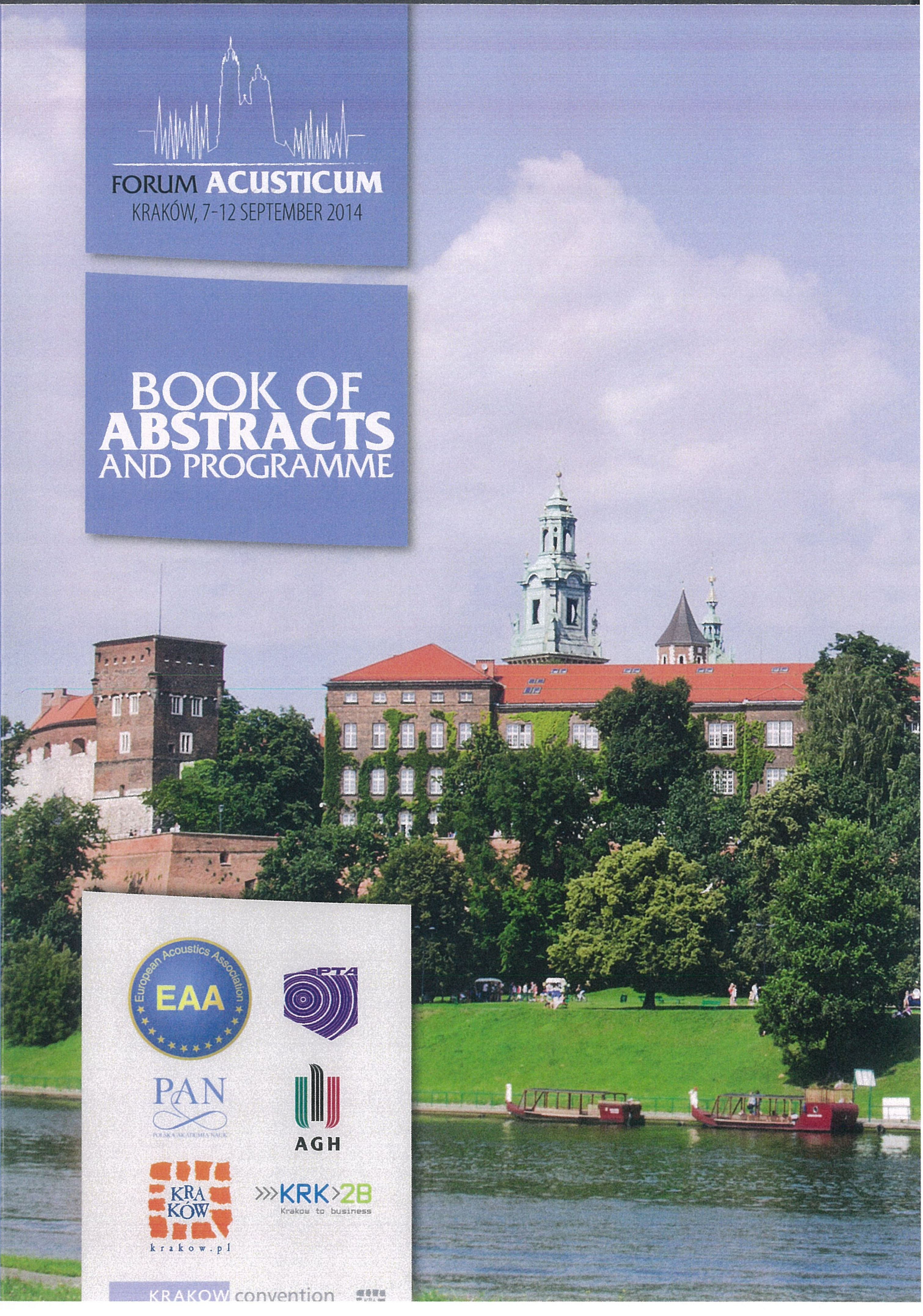

FORUM ACUSTICUM

KRAKÓW, 7-12 SEPTEMBER 2014

BOOK OF ABSTRACTS AND PROGRAMME

European Acoustics Association EAA

PTA

PAN

AGH

KRA KÓW krakow.pl

KRK>2B Krakow to business

KRAKOW convention

ULTRASONICS

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The Acoustic Method As a Precise Tool For the Determination PρT Data of Liquids

Invited Paper **Schedule: Wednesday 09:30**
Building: D1, Room: WA3

MARZENA DZIDA
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High-pressure thermodynamic properties of liquids are of considerable interest from the fundamental and practical points of view. Their knowledge lets understand better the type and nature of the intermolecular interactions, thus develop adequate models of the liquid state. The high-pressure data help in developing technologies that require working liquids exposed to changing pressure, e.g. those of fuels, refrigerants, cleaning and foaming agents, etc. The acoustic method has found acceptance as a precise tool for the determination of thermodynamic properties of compressed liquids. The pρT data obtained from the experimental speeds of sound belong to the most reliable ones because the speed can be measured accurately over wide range of temperatures and pressures. In the calculations, the experimental speeds of sound under high pressures have been used, together with the densities and heat capacities at atmospheric pressure as a reference one. The uncertainties do not exceed ±0.05 % and ±1 % for the calculated high-pressure density and the heat capacity, respectively.

Aggregation Processes in Concentrated Magnetic Fluids As Studied by Ultrasonic, Magnetic and Rheological Methods

Invited Paper **Schedule: Wednesday 09:50**
Building: D1, Room: WA3

TOMASZ HORNOWSKI
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Magnetic fluids are colloidal suspensions containing magnetic nanoparticles, usually ferrite-based (MFe2O4), dispersed in organic or inorganic liquid carrier. Due to the possibility of remote controlling fluid's parameters using magnetic field, magnetic fluids have attracted considerable interest in their potential application in technological, biological and medical fields, such as seals, bearings, sensors, drug delivery, or magnetic hyperthermia. The internal microstructure formed in magnetic fluid under the influence of the magnetic field gives rise to a significant change in velocity and ultrasonic attenuation of the ultrasound with the respect of the direction of magnetic field. This so-called field-induced ultrasonic anisotropy depends, generally, on magnetic field strength, magnetic particles concentration and temperature. In this work the effect of magnetic field on the aggregation processes in the transformer oil-based magnetic fluid with various concentrations of magnetite particles was studied. Experimental data obtained from ultrasonic, rheological and magnetic measurements give the evidence of the microstructure formation in the magnetic fluid studied under the influence of the external magnetic field.

Controlling the Depth of Local Tissue Necrosis Induced by Pulsed Nonlinear Focused Ultrasonic Beam with Electronically Sliding Focus

Contributed Paper **Schedule: Wednesday 10:10**
Building: D1, Room: WA3

TAMARA KUJAWSKA
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WOJCIECH SECOMSKI; MICHAŁ BYRA; ANDRZEJ NOWICKI

To target a pulsed ultrasonic beam focus on a tumor located deep in tissues during thermo-ablative treatment with HIFU technique, beams with different focal distances are required. To be able to control a depth of local thermal fields induced in tissues by single beam both, the plane and concave 7-element annular phased array transducer with a frequency of 2 MHz and diameter of 29 mm were designed and built. The radius of curvature (ROC) for the concave transducer was equal to 60 mm. The transducer elements had the same area to provide uniform pressure distribution on their surface due to the same impedance and were excited by pulses with time delays providing the beam focusing at three different depths (25 mm, 30 mm, 35 mm). To select sets of time-delays for each focal depth the measurements of pressure waveforms on the axis of the beam generated in water were performed using a needle hydrophone. For this measurements 10-cycle tone bursts with 1 kHz PRF were used. In order to induce local thermo-ablative necrosis inside a tissue at three different depths (10 mm, 15 mm and 20 mm) a two-layer system of wave propagation media comprising of 15 mm water and 25 mm pork loin was used. To heat locally the pork loin the 20-cycle tone bursts with 0.2 duty-cycle and average acoustic power of 12 W (the initial pulse intensity ISATA of about 2 W/cm2) was used. In order to determine the exposure time required to induce necrosis (rise in temperature above 56 degC) in the pork loin at the selected depth the thermocouples placed on the acoustic beam axis were used. After exposure to ultrasound 3 necrotic spots were observed after the cutting the tested tissue sample along the beam axis. The obtained results proved the feasibility of controlling the depth of local tissue necrosis using pulsed focused ultrasonic beam with an electronically sliding focus generated from the planar or concave multi-element annular phased array transducer.

The Acoustic Cavitation and Sonochemistry

Invited Paper — **Schedule: Wednesday 11:00**
Building: D1, Room: WA3

KYUICHI YASUI
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Although acoustic cavitation noise is often measured in experiments of acoustic cavitation and sonochemistry, the mechanism of the broad-band noise is still under debate. In the present study, numerical simulations of acoustic cavitation noise are performed taking into account the temporal fluctuation in the number of bubbles. The results indicate that the temporal fluctuation in the number of bubbles results in the broad-band noise [K.Yasui et al., Ultrason.Sonochem. 17, 460-472 (2010)]. At a high number density of bubbles, the bubble-bubble interaction intensifies the broad-band noise. In low-concentration surfactant solution, the broad-band noise is much weaker than that in pure water because the bubble size is much smaller due to the inhibition of bubble coalescence by surfactant so that the bubbles are shape stable resulting in much less temporal fluctuation in the number of bubbles. It is consistent with the experimental observation by Ashokkumar et al. [J.Am.Chem.Soc. 129, 2250-2258 (2007)].

A Search For the Physical Origin of Acoustic Wood Anomalies.

Invited Paper — **Schedule: Wednesday 11:20**
Building: D1, Room: WA3

NICO DECLERCQ
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JINGFEI LIU

In the spectrum of a broadband beam reflected from a periodically corrugated surface spectral anomalies such as sharp dips have been observed earlier and identified as acoustic Wood anomalies due to its similarity to the optical Wood anomaly. Although some assumptions have been proposed for the cause of this phenomenon in the past, its real physical origin is still not clear. In this work a thorough investigation of the physical origin of the acoustic Wood anomaly is made. The experiment is performed on a periodic brass surface with a rectangular profile. The existing explanations of acoustic the Wood anomaly are reviewed, examined and evaluated based on the analysis of the experimental results obtained from three types of interfaces: liquid-solid, solid-liquid and solid-air interfaces. Time-frequency domain analysis is introduced and the resultant sonogram of the specular reflection disproves the commonly accepted energy loss assumption for the origin of acoustic Wood anomalies. It is pointed out that the spectral dip is not an actual destructive interference, but a virtual one caused by the data processing method (FFT). Based on the phase difference between the reflected signals involved, spectral dips and tips are proved to be the result of constructive and destructive interference effects, respectively. Finally, a complete explanation of the physical process of the acoustic Wood anomaly is given.

Full Angle Ultrasound Spatial Compound Imaging

Invited Paper — **Schedule: Wednesday 11:40**
Building: D1, Room: WA3

KRZYSZTOF OPIELIŃSKI
(Faculty of Electronics, Wroclaw University of Technology; kopi@pwr.wroc.pl)

Multi-angle spatial compound images (MACI) are usually generated by averaging the recorded single-angle images obtained by means of a conventional B-mode ultrasonic scanning. In this technique, images are recorded from a number of different angles (typically 3 to 9). These single-angle images are then combined to form the compound image. Compound images can be recorded using a linear array of piezoceramic transducers connected to an ultrasound system with a high number of channels that allow for a precise beam-steering. MACI offers noticeable image improvements, due to reduced angle-dependence and reduced speckle in the compound image, compared with a conventional B-mode imaging. This work approaches the ultrasound compound imaging with a full angle spatial concept.