

**CURRENT TRENDS OF THE WORKS ON ACOUSTICS PRESENTED
AT THE XLVI OPEN SEMINAR ON ACOUSTICS OSA'99**

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The XLVI Open Seminar on Acoustics was held in Zakopane from the 14th to the 17th of September 1999. It was organized by Cracow's Section of the Polish Acoustic Society, the Laboratory of Structural Acoustics and Intelligent Materials, the Faculty of Mechanical Engineering and Robotics of the Academy of Mining in Cracow and the Committee on Acoustics of the Polish Academy of Sciences. The number of participants was 175. 118 papers were presented. The honorary president was Prof. Ignacy Malecki. Prof. Zbigniew Engel was chairman of the Scientific Committee and the Organizing Committee was chaired by Prof. Ryszard Panuszka.

The Seminar was opened by the plenary lecture of Prof. Ignacy Malecki devoted to the application of acoustic emission in engineering materials. The examples of new applications presented in his lecture concerned the monitoring of the technology of ceramics, the investigation of variations in the structure and microstructure of those materials caused by thermal shocks and the monitoring of the behaviour of constructions under conditions close to those prevailing during their long term exploitation as well as the analysis of mechanical and thermo-mechanical parameters in that plasticity and pseudoplasticity effects have been considered.

At the beginning of the proceedings in each section a plenary lecture was given. All in all, seven lectures were delivered. Prof. Antoni Jaroszewski discussed the perception effects of an acoustic injury caused by exposure to music sounds with reference to loudness, height discrimination and the frequency and time resolution. Musicians are particularly subject to those injuries. Significant lasting, selective and high-frequency losses in their hearing were found. They indicate that the hearing protection of this group of people is insufficient.

Prof. Eugeniusz Kozaczka focused his lecture on some problems of the non-linear effects connected with the generation and propagation of elastic waves in water, on non-linear properties of a medium as well as on making use of those properties in parametric sources of acoustic waves. Prof. Adam Lipowczan characterized the usefulness of modern

GIS and GPS techniques in the solution of problems connected with the dangers of vibroacoustic effects to the environment. Those techniques, linking computer maps with data bases, offer new research methods and applications to the study of the propagation of noise and mechanical vibrations in the environment.

Dr Henryk Łopacz presented the possibility of the simulation of audio monitoring in physical as well as in virtual rooms. The simulation of audio monitoring conditions is realized by a convolution of pulse response for a given transmission way and the test signal. In the algorithms presented, the influence of room dimensions, the locations of transmitting and receiving points and the attenuating properties of the room can be taken into account. Profesor Stefan Weyna discussed the analysis of measurements of the vector effects of an acoustic wave represented as sound intensity in the acoustic field of real sources. The results presented concerned measurements of acoustic phenomena occurring in the near field and in small limited areas. The application of a broad-band three-way system to the identification and classification of sea fish shoals was presented by Professor Manell Zakharia. The main construction problems of this device concern the transducers, the levels of the transmitted and received signals, the directivity and impedance variations in the whole frequency region. For a correct working of the device, the algorithm of identification of the fish species is also essential. It was shown that neuron nets can be applied to this end. The device discussed is characterized by a high linearity and a better estimation of the fish size. The identification of the fish species is based only on the characteristic frequencies of the received echo.

The plenary lectures presented

Ignacy Malecki, Jerzy Ranachowski, Przemysław Ranachowski: New applications of the acoustic emission (AE) in materials engineering; Antoni Jaroszewski: Perception effects of the acoustic injury caused by the exposure to music sounds; Eugeniusz Kozaczka: Non-linear waves in water; Adam Lipowczan: The perspectives of the application of the GIS and GPS techniques in vibro-acoustic investigations of the environment; Henryk Łopacz: Models of pulse responses of rooms; Stefan Weyna: Application of the intensity method to the vector analysis of the acoustic field of real sources; Manell E. Zakharia: Wideband systems for fisheries, from individual echoes to fish classification at sea.

The acoustics of speech

The focal points of these papers were the problems of determination of speech transmission quality, elimination of disturbances and echoes in loud-speaking devices, the identification of voices masked by the speaker, the perception of amplitude and frequency modulated signals, the creation of an acoustic data base for the Polish language and the analysis of speech of stammering persons. Also, papers pertaining to the analysis of the vowel quotient were presented. Investigations performed on a group of 24 persons have indicated that the vowel quotient is the most important acoustic feature for the determination of the phrase limit. In the Polish language, the lengthening of the terminal part of the phrase concerns mainly the last or the penultimate vowels regardless of whether

they are accented or not; the lengthening effect becomes however more pronounced when those vowels are accented. The problem of the classification of stop consonants analysing the features of segments of variable length. The identification of voiceless implosive consonants, /p/, /t/, /k/, was discussed as well. The classification of sounds was done by neuron networks on the basis of cepstral coefficients obtained from the complete course of a sound; the results have been compared with those calculated on the basis of the short-period Fourier transform at the starting point of the implosion. The investigations performed have shown that there is a small decrease (3.5%) in the recognition of stop consonants when the characteristics of their complete course are used by a simultaneous simplification in the obtaining of those characteristics. The recognition of speakers on the basis of their speech has different applications. Masking of the speech results in a deterioration of the recognition results. There have been discussed experiments aimed at the determination which one of the commonly used speech signal parametration techniques is most resistant to voice masking. The problem of the non-fluent speech was discussed in terms of the variation in the concentration of the breathed out CO₂ by both stammering and fluently speaking persons during different sorts of speaking like reading, talking and talking with echo. For the recognition of consonants in the speech of stammering speakers, a computer visual echo was presented. An echo basing on the recognition of Polish syllabic vowels was shown. Also, the effect of the echo on the duration of sounds in the fluent fragments of speeches of stammering speakers was determined. A significant increase of the duration of vowels as well as consonants is observed. The automatic recognition of sound and speech requires the preparation of a proper base. The progress in the preparation of such a base for the Polish language was reported. The recording platform and elements of the basis was discussed. A measuring set for the objective evaluation of the speech transmission quality in telecommunication channels using loudness indices was presented. A review of subjective methods of such an evaluation was given as well. The Polish normalizations concerning the requirements and measuring methods of the logatomic clarity were discussed. The echo and interference control in terms of psychoacoustics was applied to the quality improvement of loud-speaking devices, particularly to that of cell phones. For the amplitude and frequency modulation of signals, the binaural perception was investigated for modulations of different deepness and frequency deviations.

The following papers were presented:

Krzysztof Bielawski: Psychoacoustics aspects of systems eliminating echoes and interferences in loud-speaking devices; Stefan Brachmański: An objective measurement of the speech transmission quality by the method of loudness indices; Stefan Brachmański: A subjective measurements of the speech transmission quality in telecommunication channels; Grażyna Demenko, Stefan Grocholewski: The acoustic analysis of the consonant quantity; Ewa Łukasik: Classification of stop consonants on the basis of the features of segments of varying length; Wojciech Majewski, Grażyna Mazur Majewska: Speech signal parameters of a voice masked by the speaker; Edward Ozimek, Jacek Konieczny: Binaural deepness of modulation for an AM signal evaluated theoretically and determined exper-

imentally; B. Raczek, B. Adamczyk: Variations of the amount of CO₂ exhaled during a fluent and influent speech; Elżbieta Smolka, Beata Fornal: The recognition of vowels in the speech of stammering persons; Piotr Staroniewicz: The detection of interform transitions for the needs of ARM; Piotr Staroniewicz, Jerzy Sadowski: The acoustic data base SpeechDat for the Polish language; Waldemar Suszyński, Wiesława Kuniszyk-Józkowiak, Jolanta Dalczyńska: The impact of the echo on the duration of vowels in the speech of stammering persons; A. Wicher, E. Ozimek: Dichotomic perception of signals of modulated frequency.

Acoustics of music

A statistic method of the evaluation of results of psychoacoustic investigations performed by the method of tuning. The methodology presented allows the proper preparation of a measuring experiment, i.e. the determination of the number of an audio monitoring groups, the number of the repetitions of the measuring task and the verification of the statistical reliability of the results. From the analysis of the acoustic pressure levels generated when playing percussion instruments, a hypothesis was formulated that short increasing times at relatively high peak levels cause specific unpleasant impressions of "ear clogging" by the drummers and can result in their specific hearing losses in a broad frequency range. Also, the sound levels and pulse characteristics of discotheque expositions was investigated from the point of view of the hearing loss hazard to the musicians and the audience.

The following papers were presented:

Elżbieta Aramowska, Piotr Rogowski: The problem of the trial number in psychoacoustic experiments by the tuning method; Antoni Jaroszewski, Anna Jaroszevska: Pulse characteristics of discotheque expositions; Antoni Jaroszewski, Piotr Rogowski, Andrzej Rakowski: Statistical analysis of the acoustic pressure levels when playing percussion instruments during training sessions; Lubomir Rotko: The sound levels of pop music.

Sounds in the environment

The research devoted to the propagation of sounds in the environment include the problems of determination of the sound propagation conditions, the common sound sources and the noises of typical objects, such as buildings, highways, power lines etc. The results of studies on the occurrence frequency of meteorological conditions being conducive to the propagation of the acoustic wave in the environment. Analyzing the data of meteorological stations, the frequency of conditions conducive to the propagation according to ISO, CONCAWE, and the wind component from the source to the receiver, were considered. The general relationships for the total acoustic power radiated by a system of harmonic point sources in a free space and in the presence of reflecting surfaces were given. Methods of forecasting the traffic noise applying numeric techniques

to the estimation of and decreasing of bothersome noise generated by communication routs. The noise of power lines was analysed in order to find relationships to radio and television interference. The analysis of spectra of noise generated by a railway bridge enabled the determination of the contribution arising from the rolling and that arising from the bridge structure. For the evaluation of the acoustic pressure level increase caused by the oscillation of building partitions, a measuring and calculation method, based on two-channel simultaneous measurements of the acoustic pressure level and the speed of the partition oscillations, was proposed. The Method of the Statistic Analysis of Energy was applied to the calculation of the side acoustic insulating power in houses made by the "Thermomur" technology.

The following papers were presented:

Henryk Idczak, Anna Snakowska: The symmetry of the sound sources in relation to the reflecting surface; Gabriel Kubinyi, Jerzy Wiciak: Analysis of the side acoustic insulating power of the "Thermomur" system by the Method of the Statistic Analysis of Energy; Robert Łopusiak: Forecasting of the traffic noise; Marek Niemas: The calculating and measuring method for the determination of the acoustic pressure level increase caused by oscillations of rooms arising from heavy traffic; Edyta Pilat: Acoustic insulation made of the Gullfiber Polska wool; Krzysztof Rudno-Rudziński: Distribution of the frequency of conditions conducive to the sound propagation in different regions of Poland; Krzysztof Rudno-Rudziński: Spectra of sounds generated by a railway bridge; Jerzy Wiciak, Ryszard Panuszka, Gabriel Kubinyi: The choice of a model for the analysis of the side acoustic insulating power of the "Thermomur" system by the application of the Method of the Statistic Analysis of Energy; Tadeusz Wszolek: Vibroacoustic studies of corona effects of wires supplied by a high voltage.

Acoustic Emission

The papers concentrated on the ultrasonic determination of mechanical properties and the thermal resistance of thin layers as well as on the ultrasound absorption in magnetic liquids and the Brillouin scattering in liquids and crystals. Also the influence of technological conditions on the properties of piezoceramics and the modelling of those materials by the method of finite elements were discussed. An acoustic emission method of determining the initial temperature of casting moulds was proposed for alloys that a phase deforms by slip. A method of determination of the total mineralization of water by ultrasonic velocity measurements was presented. Results measurements of ultrasound speed anisotropy and the mechanical properties of piezoelectric materials was presented as well. The results make it possible to determine the distributions of the wave velocities and heterogeneities as well as the static Young's modulus. A modification of technological conditions of the production of ceramics by the method of hot sintering and polarization by an electrostatic field leads to maximum values of the piezoelectric modulus and of the electromechanical coupling coefficients. The application of the acoustic emission for the investigation of small variations in the strength of ceramic materials caused by small

thermal shocks was presented; also, the dependence of the acoustic emission level during bending on a previous thermal shock was discussed. The application of photoacoustic and photothermic impulse methods for the determination of thermal and transport parameters of semiconductors was analysed. The successful tests of designing and optimisation of the properties of ultrasonic transducers by the method of finite elements enables us to avoid the constant constructing and measuring of new physical models of transducers which are expensive and time-consuming. Experimental studies of structural changes of magnetic liquids, due to the formation of clusters, and the variation of the absorption coefficient, depending on the rate of the magnetic field and temperature variations, were presented. The determination of the thermal resistance of thin layers deposited on a thick basis is possible by an analysis of the crossing of a thermal wave through the sample-base interface. The highest sensitivity is achieved by a thermal fitting of the base to the liquid above the sample. Favourably is also the deposition of the layers under test on possibly thin bases. The application of the matrix calculus was suggested for the description of thermal waves generated by a modulated energy stream. The matrix formulae obtained are a convenient starting point in further calculations of the influence of the particular layers on the distribution of the temperature field in the sample and its environment.

In many papers concerning the acoustic dust removal the problem of electrification of the dust is omitted or its effect on the occurrence of the phenomena is not taken into account. The analysis of electric interactions during the acoustic agglomeration leads to the conclusion that the coagulation time is shortened when the aerosol particles are electrified by opposite charges; in this way the effectiveness of the coagulation process increases.

The following papers were presented:

Małgorzata Bebek, Krzysztof Mitko, Krzysztof Bebek: Determination of the salinity of surface and abyssal waters by acoustic methods; Tomasz Błachowicz, Zygmunt Kleszczewski, Tadeusz Łukasiewicz: Brillouin scattering in the SrLaGaO_4 (SLG) and SrLaAlO_4 (SLA) single crystals; Jerzy Bodzenta, Jacek Mazur, Bogusław Burak: An analysis of the possibilities of determination of the thermal resistance of thin layers deposited on thick bases by the photothermic method; Henryka Czyż: Electrified particles in the acoustic field; Tomasz Dębowski, Zbigniew Ranachowski: Measurements of the acoustic emission in construction materials exposed to thermal shocks; Julian Dudek, Dariusz Bochenek, Włodzimierz Rogulski, Zygmunt Surowiak: The effect of technological conditions on the properties of the S-1 piezoceramics; A. Józefczak, Mikołaj Łabowski, Andrzej Skumiel: The influence of the rate of magnetic field variations on the coefficient of ultrasonic absorption in a magnetic liquid; Michał Kępiński: Application of neuron networks and analysis of the main components (PCA) to the visualization of multi-dimensional information exemplified by a pathological speech signal; Leszek Książek, Mikołaj Baszun: Application of the ANSYS package to the analysis of structure oscillations including piezoelectric materials; Waldemar Lis, Roman Salamon, Józef Zielenkiewicz: Statistic investigations of the parameters of acoustic signals emitted by the temple jaw joint; Dariusz Madej, Tomasz Hornowski: Ultrasonic investigations of the

critical benzonitrile-isooctane mixture; Justyna Matachowska, Jan Ilczuk: Determination of the velocity and mechanical anisotropy of the PZT piezoceramics by the ultrasound method; Jacek Mazur, Jerzy Bodzenta: Application of the matrix calculus to the analysis of varying temperature fields in photothermic and photoacoustic experiments; Barbara Pustelny, Zygmunt Kleszczewski, Jerzy Bodzenta: The photoacoustic effect in semiconductors; Leszek Radziszewski: Analysis of laser generated interferences in plastics and the acoustic emission; Zygmunt Surowiak: Piezoelectric electroacoustic transducers of different ferroelectric hardness.

Hydroacoustics

The papers dealing with hydroacoustics concentrate on the influence of meteorological conditions on the propagation of acoustic waves, underwater disturbances caused by swimming objects, determination of geographic positions and detection of targets, identification of the sea beds, construction of hydrolocation aeriels and sonars and so on. A hybrid neuro-fuzzy classifier of a multistage structure for the recognition of the sea bottom by acoustic echoes was presented. The results are better than those obtained by a parallel ANFIZ system and it needs a smaller calculation power. A multifrequency classifier with diffuse neuron webs was constructed for the identification of pelagic fish species and the type of sea bed. The classifier is a three-layer artificial neuron web, with a reverse error propagation, in that the knots of the first layer represent the input parameters, the second layer represents diffuse rules and the third one represents the classes. The method of reverse filtration, that makes use of the window decomposition, makes it possible to get a dependence of the coefficient of dispersion from the bottom on the angle of incidence or on the deepness in the sediment.

The precision of the localization of small underwater objects in opaque reservoirs is significant for a quick finding of such objects by scuba divers. The detection of targets by a side sonar with a towed carrier of hydroacoustic aeriels, in relation to the position of ship towing the carrier obtained by the GPS system, was discussed in papers concerning the sources of errors, their minimization by additional systems measuring the deepness of draught and the height of the carrier above the bottom, the linearization of the sonar range and the compensation of the effect of bending of the sound propagation route in the reservoir. For increasing the accuracy of positioning of targets, the methods of formation of multielement hydroacoustic aeriels have been applied. The method of electric joining of equal transducers and selection of the surface of those transducers was presented. Both the methods eliminate the construction of multi-channel sending and receiving systems that are necessary in the commonly used method of electronic or numeric weighing. The architecture of the perceptron affects the quality of filtration of the navigation parameters that can be used in the system of detection of underwater objects by the acoustic method. The effect of the number of layers and of neurons in the hidden layers of the Kalman's neuron filter was investigated. A front sonar of a high angle and penetration resolution with a linear sending-receiving transducer of moderate size and a limited number of receiving paths was presented. Another construction presented was a sonar with an arc

cylindrical transducer shaped by the linear method of delaying signals from the particular elements. The immediate obtaining of a complex cylindrical snapshot for the beamformer FFT was presented as well.

The following papers were presented:

Jerzy Dobrzyniecki, Ignacy Gloza: Underwater disturbances caused by the main ship motor; Tran Van Dung, Joanna Maciołowska, Andrzej Stepnowski: Sea bottom recognition using mufti stage neuro-fuzzy classifier operating on multi-frequency data; Andrzej Elminowicz: Front sonar of a high angle and penetration resolution; Grażyna Grelowska, Ignacy Gloza: The effect of variations of the hydrological conditions on the propagation of acoustic waves in the South Baltic Sea; Lech Kilian, Jacek Marszał, Aleksandra Raganowicz: Determination of geographic position of targets by a side sonar; Zbigniew Łubniewski, Marek Moszyński: The inverse filtering methods to the seabed identification problem; Joanna Maciołowska, Andrzej Stepnowski, Tran Van Dung: Neurofuzzy classifier for fish species identification and bottom typing operating in multi-frequency data; Artur Makar: The effect of the preceptron architecture on the filtration quality of the motion parameters of an underwater object; Władysław Męciński: Investigations of the properties of echoes from underwater objects from the point of view of increasing the detection ability of a hydrolocation station; Marek Moszyński, Zbigniew Łubniewski: Modelling of scattering using a combined (surface-volume) impulse response; Roman Salamon, A. Eliminowicz, Z. Wojan, W. Lis: Non-electronic methods of shaping the direction characteristics of mufti-element hydroacoustic aeriels.

Sound engineering

The papers concerning sound engineering were devoted to the problems of shaping the characteristics of sound sources, to the construction of corrective filters and power amplifiers and their cooperation with switches and loudspeaker sets. The investigations performed enabled the verification of the cepstrum function to the study of the degree of stochasticity of the sound reverberation energy in a room and to the evaluation of the acoustic properties of already existing rooms or those being just designed. A system of active sound reduction in a closed space was presented and the conditions affecting their efficiency were given. A mean reduction level of the acoustic level of 10 to 20 dB was achieved in the frequency range 50 to 250 Hz. The problems of diminishing linear deformations by corrective systems mounted in the signal path in front of the loudspeaker system were presented. In the case of digital switches, the compensation of linear deformations including the individual correction of each of the transducer includes also phase deformations so that the total compensation of the impulse responses of the transducers was closest to the proceeding of the Kronecker's delta. Results of measurements of the directional properties of loudspeaker sets with analogue and digital switches working in both the steady and transition states were presented as well. The results of some investigations proved that an intended change of the directional properties of the sound source can be achieved by controlling the velocity amplitude of the source.

Many papers were devoted to the construction of high-power amplifiers and their cooperation with loudspeaker sets. An example of a computer supported designing of a power bridge amplifier consisting of integrated circuits and discrete power transistors. The application of a computer facilitates the selection of the tolerance and the optimization of the resistor values, the calculation of the power losses of the integrated circuits; it enables also to minimize the coefficient of the content of the harmonics. The effects of the loading of a high-power amplifier by the loudspeaker device, connected with the mechanic resonance of the membrane, was evaluated on the basis of a computer simulation. The danger of a secondary breakdown of power transistors was determined.

The following papers were presented:

Wojciech Ciesielka: The sound synthesis by digital correctors; Paweł Dziechciński: A comparison of the designing of corrective filters; Andrzej Gołas, Ireneusz Czajka: The concept of a source of a controlled directional characteristic; Henryk Łopacz, Marek Niewiarowicz: Digital switches of loudspeaker sets; Marek Niewiarowicz, Henryk Łopacz: Directional properties of loudspeaker sets with analogue and digital switches; Zygmunt Musiałkowski, Józef Stanlik: A computer supported designing of an electroacoustic high-power amplifier with an increased output current; Józef Stanlik: A computer supported analysis of the conditions of cooperation of a high-power amplifier with a loudspeaker device; Józef Stanlik: Cooperation of a high-power amplifier with loudspeaker device; Józef Stanlik, Zygmunt Musiałkowski: The designing of electroacoustic highpower amplifiers with an increased output current; Krzysztof Śródecki: Application of the cepstrum function for the evaluation of the tone quality in rooms.

Active Methods, Vibroacoustics

Beside acoustic emission, this branch of acoustics was the most represented one. Eighteen papers significant for the recognition, theory and applications were presented. The Green's function method, used in the study of propagation of acoustic waves in randomly heterogeneous media, was applied to the description of the behaviour of electrons in the energy band with a random distribution of impurities. A relationship between the energy and momentum of the electrons was derived for the Orstein-Zernike form. From a theoretical analysis of the acoustic radiation of annular plates integral formulae were derived that describe the acoustic radiation of a fixed circular plate. Asymptotic formulae of an elementary form were obtained that facilitate numeric calculations. In these formulae, the non-oscillating part was separated from ten oscillating one. For a circular plate, also the determination of an optimal controlling force was considered, i.e. the determination of a force that reduces the oscillation and the acoustic pressure radiation in active systems. Beside the desirable amplifying vector for the vector of state, the optimal control found contains also a correction resulting from the consideration of the acoustic pressure in the quality indicator. The simulation studies performed indicate a 40 percent reduction of the acoustic pressure radiation. For the method of finite elements, a circular element in polar coordinates was worked out. An algorithm for an analytical description of the

shape function was proposed. Pictures of some particular cases of those functions were presented. Using the energy analysis of a ribbed plate, relationships were derived that determine the amount and distribution of the energy dissipated and accumulated by the plate and the system of ribs.

The investigation of mutual phenomena made it possible to determine the acoustic transition functions. In the measuring stand presented, a satisfying agreement between the real, measured acoustic pressure and that predicted was achieved.

Circular saws are the main source of vibroacoustic danger in the manufacturing process of cutting. The vibroacoustic analysis indicates that the knowledge of the particular forms of the free vibrations allows to reduce effectively the vibrations of the saw-blade disc by gland rings, additional stiffing discs, bearing pad discs and by a proper choice of the number of teeth, their geometry and the number of revolutions. A lot of work was devoted to problems of the noise of strokes and of hydraulic presses. A stand for the investigations of striking noise was presented as well as material and constructing solutions decreasing the noise of this type during mechanical work. Impulse noise was investigated in order to determine the statistical value of some parameters characterizing isolated impulse noise obtained from measurements in three industrial plants. The possibility of active noise decreasing was demonstrated by an example of the low frequency noise reduction in a ventilation system. The results of preliminary studies, including measurements of the effectiveness and stability of active noise decreasing systems, were presented. A new system of the acoustic analysis, based on the application of the edge elements method, was demonstrated. The systems allows the user to identify the influence of the structural elements on the sound level in chosen areas of the structure. Using the method of the Statistical Analysis of Energy, an algorithm was suggested and a corresponding computer program for the calculation of the energy spreading in mechanical-acoustic systems was worked out. An example of the application of this program was the optimization of the acoustic energy radiation by a ribbed plate placed in three dimensional acoustic volume. The method of the Statistical Analysis of Energy was also applied for a procedure of determination of the coefficient of energy losses in stochastically vibrating structures; in the procedure the interaction between the structure and the acoustic field is taken into account. In sound-isolated cabins used in the industry, their effectiveness in the low frequency range is essential. This effectiveness can be markedly improved by the application of resonance structures. In several papers, a conception of the application of individual characteristics of vibroacoustic sets and sub-sets in the production and utilization of motor vehicles was presented. Attention was paid to the possibility of drawing up a consulting system assisting the diagnosis of the technical state of both new and used vehicles. A similar system can be used to aid the designing of means of passive reduction of the machine noise.

The following papers were presented:

Wojciech Batko, Pawel Litwa, Ryszard Olszewski: Analysis of the acoustic field around a friction saw; Adam Brański: The idea of a circle element in the method of finite elements; Zbigniew Engel, Jan Sikora, Jadwiga Turkiewicz: Noise in mechanical work;

Zbigniew Engel, Jan Sikora, Jadwiga Turkiewicz: Experimental studies of striking noise; Zbigniew Engel, Aleksander Gawlik, Mirosław Gawlik: Experimental studies of vibroacoustic mutual phenomena; Andrzej Gołaś, Robert Łopusiak, Piotr Malcharek: Vibroacoustic diagnosis — application of the method of edge elements; Marek Iwaniec: Analysis of the effect of the parameters of ribbing of a rectangular plate on the free vibration frequency; Marek Iwaniec, Ryszard Panuszka: Analysis of the energy spreading in a mechanical-acoustic system; Anna Kaczmarska, Danuta Augustyńska: Methods of reducing the low-frequency noise in industrial cabins; Jan Kazimierczak, Wojciech Moczulski, Arkadiusz Boczkowski: The conception of the application of individual characteristics of vibroacoustic sets and sub-sets in the production and operation of motor vehicles; Marek Komoniewski: An integrated assistance of the designing of means for the passive reduction of noise — the construction of a tool; Lucyna Leniowska: Active attenuation of vibrations and the acoustic pressure radiated by a circular plate; Lucyna Leniowska: Simulation of the active attenuation of vibrations and the acoustic field radiated by a circular plate; Lucyna Leniowska, Andrzej Szumidło: Active attenuation of the vibrations of a circular plate — experimental investigations I; Grzegorz Makarewicz, Grzegorz Matuszewski, Leszek Morzyński, Wiktor Zawieska: A stand for the study of the active reduction of noise in ventilation systems; W.P. Rdzanek: Theoretical analysis of the acoustic radiation of fixed circular plates; Eugeniusz Soczkiewicz: The Green function method of the study of propagation of acoustic waves in randomly heterogeneous media — electrical analogs; Jan Aęra: Some parameters of impulse noise at working positions in the industry.

Acoustic methods in biomedical engineering

The applications of acoustic methods in biomedical engineering were presented in the context of measurements of blood pressure, the investigation of bones, the propagation of blood pressure waves, the effect of infrasound of bioelectrical potentials in the brain, and its effect on the variation of the EEG signal. The results of the studies of the bioelectric courses in the human brain indicate a high sensibility of the central nervous system, even at a low acoustic pressure of the infrasounds. This can be manifested by an increase of the alpha rhythm, by the appearance of a slowly changing activity theta and by and by the appearance of the leading phenomenon. This shows a lack of concentration and a disturbance in the psycho-motoric efficiency. It was shown by the ultrasound transmission tomography that the application of stochastic filters enables the minimization of image deformations. The reconstruction of an image is performed by a convolution algorithm and a reverse projection. The acoustic non-invasive method of measurement of the running and reflected blood pressure wave in the human neck artery makes it possible to evaluate of the degree of narrowing of the inner neck artery basing on the reflection coefficient and the delay of the reflected wave in relation to the running one.

The measurements of the propagation of ultrasonic waves in three perpendicular directions in anisotropic samples of the spongy and bark bone tissues indicate a strong correlation between the density of the a bone and the ultrasound velocity. An acoustic

microscope, operating at 100 MHz, has been used for the determination of the impedance and speed of propagation of a longitudinal ultrasonic wave in separate beams of a spongy bone. It was found that in the case of osteo-optic beams, the density and velocity of propagation of longitudinal waves are close to those obtained for a packed bone. The diminishing of the mineral phase in the collagen structure of the beam, or its complete absence, results in a decrease of density and ultrasound velocity.

The following papers were presented:

Zbigniew Damijan, Ryszard Panuszka: The effect of infraacoustic noise on the bioelectric potentials of the brain; Zbigniew Damijan, Ryszard Panuszka: The influence of infraacoustic noise on some parameters of an EEG signal; Andrzej B. Dobrucki, Krzysztof J. Opieliński: The application of a stochastic filter to an image reconstruction by the UTT method using a convolution algorithm and reverse projection; Jerzy Litniewski, Andrzej Nowicki, Andrzej Sawicki: Micro-measurements of the properties of spongy bones by an acoustic microscope; Tomasz Majchrzak, Marek Iwaniec: An acoustic method of quantitative investigations of bones; Tadeusz Powałowski: The study of running and reflected blood pressure waves in the human common neck artery by a non-invading ultrasonic method; Hanna Trębacz, Helena Gawda: Anisotropy of the speed and attenuation of ultrasounds in the bone tissue.

Normalization in the field of vibrations and sounds

An energetic method of the evaluation of local vibrations transmitted to the main — operator has been suggested. New criterion quantities have been proposed; they consist in the energy dose in [J] and in the mean energy measured in [W] that is directed to the operator in a single work shift. This method renders the unambiguous evaluation of local vibrations and designing of safe work positions possible. New proposals of acceptable levels of the exposition to infra- and ultrasound noise were given. Studies concerning the effect of mechanical vibrations in systems consisting of the operator's hand and the tool's handle make it possible to work out an indicator method of the evaluation of the influence of mechanical vibrations. Indices related to the effect of the tightening force and that exerted on the tool's handle by the operator were determined. A unique stand for the investigation of acoustic anti-noise ear-flaps, with a controlled attenuation, which meet the European norm pr EN 352-4. The stand allows to perform investigations of fundamental hearing savers and certificate investigations. An automatic audiometer allows to test the hearing of persons subject to noise by applying a scanning method in that three measurement procedures are used. The test results can be archived and the trend of the decrease changes observed. The application of the intensity method for the determination of acoustic pressure levels of the emission enables an accurate determination of the latter at the utilization conditions according to the demands of the series of EN ISO 11200 norms. Also, the results of measurements of the acoustic pressure of 32 woodworking machines, performed according to the Pr PN EN ISO 3746 norm, were demonstrated.

The following papers were presented:

Bolesław Bogusz: Procedures and accuracy classes of the determination of the acoustic power of noise sources in the light of the ISO 9614-1 and ISO 9614-2 norms; Marian W. Dobry: An energetic method of determination of local vibrations; Maria Kameduła, Małgorzata Pawlaczyk-Łuczyńska: Proposals of new acceptable levels of ultrasonic noise for the work medium; Ewa Kotarbińska, Dariusz Puto: A stand for the investigation of anti-noise ear-flaps with controlled attenuation; Piotr Kowalski: Investigations of the vibration transmission in the system: operator's hand-handle; Witold Mikulski: Corrected acoustic power level A of woodworking machines determined by the method described in Pr PN-EN ISO 3746; Małgorzata Pawlaczyk-Łuczyńska: Proposals of new acceptable quantities in relation to the professional exposition to infrasounds; Dariusz Pleban, Danuta Augustyńska: A method of determination of the acoustic pressure of emission at working places for the acoustic evaluation of machines; Tadeusz Rabsztyn, Adam Lipowczan: A device for the examination of the hearing of persons subject to noise at the working place in the light of the PN-EN 26189 project; Janusz Kompała: Analysis of the risk in town and country planning in the light of the demands of the national law; an example of the evaluation of the acoustic arduousness of a chosen industrial plant.