1st ONLINE ASEAN INTERNATIONAL ACOUSTIC WORKSHOP

ABSTRACTS

Abstract No.1

Silencing the Noise: A Regional Study of Noise Levels in Data Centre

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Data centres have been a cause of concern for many years due to their high noise levels. This is a potential health hazard for employees working in such an environment and may result in hearing loss and other health problems. To identify potential characteristics of this work environment, noise monitoring was conducted across several countries, including Japan, Malaysia, and Australia for a combine total of 36 sites, The aim of this paper was to identify potential areas of interest by measuring and mapping noise levels using specialized software. Octave frequency analysis was also carried out to help determine the appropriate control measures that could be put in place. Our findings showed that noise levels in the data centres were generally below 85 dBA, with particularly high levels in the aisle directly behind the servers. This is also true for personal noise monitoring that was carried out. The results of the octave frequency analysis revealed that the frequency range was consistent with all the locations measured, and fell within the appropriate range. It is important for companies to conduct regular noise monitoring in all their facilities to identify and mitigate any potential noise hazards. Furthermore, this study focused mainly on mitigation, but it is possible to use octave frequency analysis to identify the source of the noise and rectify it at the point source.

Abstract No. 2

Sustainable Acoustic Design of Floating Floors

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Commonly adopted methods of controlling noise and vibration in high rise buildings in Asia Pacific is to use heavyweight floors on low natural frequency isolators. However, in the context of reducing carbon emissions in the construction industry, elastomers can provide equal

acoustic performance using much lighter weight and less carbon intensive materials such as steel and concrete.

Through the use of third party acoustic laboratory testing and Life Cycle Analysis, this paper explores the use of recycled rubber material to isolate plant rooms, swimming pools, gyms and building foundations, and how they perform compare (both acoustically and in terms of carbon emissions) with traditional spring jack up floors, puck and batten and foam based isolator materials.

Abstract No.3

Application of scattering theory for calculating fields and designing an acoustic metamaterial

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Acoustic metamaterials are artificial media, usually consisting of discrete elements smaller than a wavelength. Each element is designed in such a way that the medium has the specified wave properties. With the help of metamaterials it is possible to observe negative refraction, objects cloaking, super- and hyper lensing, and other effects of practical importance. The approach to design metamaterials with the specified wave propagation properties is proposed in this report. First, the null-field method is applied to calculate the acoustical field. This method is based on the multipole expansion of the field scattered by each metamaterial element. It is sufficient to consider only a few terms of this expansion in many cases. The description of metamaterial elements is reduced then to just a few complex scattering coefficients, which form the limited set of values. This can make the method computationally efficient. The scattering coefficients and the metamaterial elements positions are picked to provide the given properties of the medium Second, the physically realizable metamaterial element design with previously defined scattering coefficients is chosen. This is equivalent to solving the inverse scattering problem. It is shown that the well-established functional-analytical methods do not allow obtaining an acceptable result. Gradient optimization methods are free from this drawback, but do not guarantee the existence and uniqueness of the solution. For the stated design problem, non-uniqueness is not a drawback, but the question of the solution existence is important. To answer it, numerical simulation of acoustic field scattering on five-layer elastic cylinders of small radius was carried out. It was shown that by choosing materials and layer thicknesses, it is possible to provide any combination of low order scattering coefficients.

Abstract No.4

Uncertainty Model of Free-Field Sensitivity Calibration of Working

Standard Microphones by Comparison Method

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To ensure traceability of measurements and research of acoustic quantities and with the issuance of IEC 61094-8: 2012 standard, about: “Measurement microphones – Part 8: Methods for determining the free-field sensitivity of working standard microphones by comparison”. So it is necessary to implement the existing free-field type of microphone and conduct research so that it can guarantee the traceability of measurements and or calibration of acoustic equipment, especially in institutions in Indonesia. The IEC 61094-8:2012 outlines the method for determining the free-field sensitivity of

working standard microphones by comparison. It is important to implement free-field microphones calibration and conduct research to establish the traceability of acoustical measurement instruments in Indonesia. The goal of this research is to develop a secondary standard microphone calibration system of the free-field type, as well as its uncertainty model. The research was conducted in the anechoic room facilities of the Sub Directorate of Acoustics and Vibration – BSN. The result shows that then the expanded uncertainty is obtained by multiplying the combined standard uncertainty by the coverage factor is about 0.11 .

Abstract No.5

The Acoustical Study of Three Local Churches in Salatiga in Relation to Their Audial Comfort in Church Services

Dr. Matias Handoyo Widhi Budhiantho (mbudhiantho@yahoo.com) and Dr. Agastya Rama Listya (agastya.listya@uksw.edu) –Satya Wacana Music Department,Faculty of Language and Arts,Satya Wacana Christian University,Diponegoro 52-60, Salatiga 50711,Central Java,Indonesia.

This research aims to determine the comfort of worshiping in 3 churches in Salatiga, and the results are compared with the results of simple measurements of room acoustics referring to ISO 3822, which is expected to describe the extent to which the congregation perceives the acoustic conditions of these churches.

The three churches chosen for this research are Gereja Kristen Jawa Salatiga Utara (North Salatiga Javanese Christian Church), Gereja Kristen Indonesia Tegalrejo (Tegalrejo Indonesian Christian Church), and Gereja Kristen Indonesia Salatiga (Salatiga Indonesian Christian Church). These three presbyterian churches are located next to the roads, where noise pollution frequently affects the quality of worship services. This research combines quantitative and qualitative approaches. The data collected from

measuring the room acoustics of these three churches and environmental noise adopts a quantitative approach, while the qualitative research applies qualitative interviews with some members of these churches to measure their satisfaction.

Abstract No.6

A Novel Paradigm on Noise Characterization, Noise Interference and Noise Measurement

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Keywords: Noise Interference; Intensity; Noise Measurement; Noise Filters; Noise Systems; Noise

A paradigm of noise interference in a wave is presented. The characterization of noise interference, due to power difference of two intensities in a wave is presented. Noise characterization of a wave is obtained depending on type of wave. The difference of two power intensities is due to transmission of light, sound, heat, electricity, fluid, and fire into a particle body. The sources of noise are classified according to the type of wave interference. Standard definitions of noise sources, their measurement equations, their units and their origins under limiting reference conditions are derived. All types of wave form one positive power cycle and one negative power cycle. The positive and negative noise scales and their units are devised depending on speed of noise interference in a wave. A noise sensor is a technological device or a biological organ that detects and senses, a noise signal or noise due to physical agents of light, sound, heat, electricity, fluid, fire and sun. In order to check occupant wellness and comfort, a noise measurement sensing system with use of a slide rule is presented. The modeling of occupant health, comfort and wellness by checking human noise behavior through noise measurement sensing system is presented. A theory of noise characterization is briefed with devised noise measurement equations.

Noise charts are presented which are used to develop noise measurement system based on sensing physical agents of noise

viz., heat, fluid, electricity, light, sound, fire and sun. Furthermore, characteristics and example of checking occupant wellness and comfort are elaborated using noise measurement sensing system. Some examples of noise filter systems as per noise sources are also illustrated. This noisinterference paradigm is supported with some numerical and experimental results.

Abstract No.7

Acoustic Parameters Analysis In An Auditorium And Rehearsal Room For A Solo Classical Piano Performance

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Keywords: Stage Acoustic, Room Acoustic, Sound Envelope, ST_{early}, ST_{late}

A musical performance can be performed anywhere both in open space and closed space. To perform a maximum hearing experience, the venue should be well considered. For example, a solo classical piano performance commonly held in closed space, since there is no enhancement to amplify the sound. Hence, a venue with decent room acoustic and stage acoustic should be applied. This study aims to analyze the parameters of the acoustic space used for solo classical piano performances. The work steps taken are based on the standardization of ISO 3382-1: 2009 regarding the measurement of acoustic parameters in the performance hall. Measurements were carried out in two places, namely the Rehearsal Room at Pelita Harapan University (UPH) by measuring only Reverberation Time (RT), and the Harry-Jusuf Auditorium at Prasetiya Mulya University (PrasMul) by measuring RT and Impulse Response (IR). Data processing is done by analyzing the impulse response and sound envelope. The measurement at UPH obtained is the reverberation time (RT) value which has an average value of 0.57 s. The measurements at PrasMul obtained RT, D50 , C80 , STearly , and STlate values. The RT score at PrasMul Auditorium has an average of 1.33 s. Then the average value of D50 is 23.62%, C80 is -1.95 dB, STearly is 4.34 dB, and STlate is 4.51 dB.

Abstract No.8

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This research aims to determine the comfort of worshiping in 3 churches in Salatiga, and the results are compared with the results of simple measurements of room acoustics referring to ISO 3822, which is expected to describe the extent to which the congregation perceives the acoustic conditions of these churches. The three churches chosen for this research are Gereja Kristen Jawa Salatiga Utara (North Salatiga Javanese Christian Church), Gereja Kristen Indonesia Tegalrejo (Tegalrejo Indonesian Christian Church), and Gereja Kristen Indonesia Salatiga (Salatiga Indonesian Christian Church). These three presbyterian churches are located next to the roads, where noise pollution frequently affects the quality of worship services. This research combines quantitative and qualitative approaches. The data collected from measuring the room acoustics of these three churches and environmental noise adopts a quantitative approach, while the qualitative research applies qualitative interviews with some members of these churches to measure their satisfaction.

Abstract No.9

ON REMOTE ACOUSTIC DIAGNOSTICS OF BOTTOM'S DISCRETE RANDOM INHOMOGENEITIES

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Abstract

Random inhomogeneities of real environments affect the characteristics of

waves propagating in these environments, and the phenomena that arise are

extremely diverse. In particular, scattered signals contain useful information about the parameters of the inhomogeneities, which can be extracted from the measurement results by solving the inverse problems of scattering theory.

Methods of remote acoustic diagnostics of environments are based on the results of solving inverse problems, which are the simplest and most environmentally friendly way to detect underlying minerals for subsequent extraction. An example of such minerals are iron-manganese nodules, which are investigated in this work. The researches conducted at the Department of Acoustics of the UNN has shown the possibility of determining the average concentration of discrete random inhomogeneities by the changes in the average intensity of the backscattered acoustic signal. It is generally assumed, that the average backscattering intensity is proportional to the square of the average surface concentration of discrete randomly arranged nodules. However, in the presence of even a slight reflection of acoustic waves from the surface underlying the scatterers, there is no longer a monotonous increase in the average intensity of the scattered signal with an increase in the average concentration of discrete inhomogeneities. We investigated the influence of the reflecting properties of bottom rocks on the remote acoustic diagnostics of discrete random inhomogeneities located at the bottom, constructed a backscattering model that takes into account the simultaneous influence of the characteristics of the surface underlying the scatterers and the uneven distribution of inhomogeneities over this surface. The obtained theoretical results were compared with experimental data.

Abstract No.10

Interplay of Acoustic Radiation Force and Brownian Motion in Particle Dynamics

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The acoustic radiation force depends on particle size, density, as well as the pressure and frequency of the acoustic wave. However, smaller particles are more susceptible to Brownian motion. This study explores the intricate balance between the Brownian force and acoustic force, which influence particle motion based on particle size and the acoustic pressure field under a critical parameter, the acoustic contrast factor (Φ). This parameter governs the direction of particle motion in an acoustic field and correlates with the densities and sound speeds of the particles and the medium. When Φ is less than zero, the acoustic radiation force propels particles toward the pressure antinode, where the maximum pressure field resides. Conversely, when Φ is greater than zero, particles are directed toward the pressure node. This examination offers valuable insights into the complex interactions between forces and particle motion in an acoustic field, advancing our understanding of such phenomena.

Abstract No.11

A numerical study on the nonlinear optimization of bubbly liquids in resonators

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The objective of this work is to optimize the generation of new frequencies obtained nonlinearly at finite amplitudes (harmonics and sum frequency; subharmonics and difference frequency) during the propagation of ultrasound in a bubbly liquid inside a resonator from a single or dual-frequency source. We use a previously developed numerical model based on the finite-volume method and the finite-difference method, which solves the nonlinear differential system formed by the wave equation and a Rayleigh-Plesset equation coupling the acoustic pressure field with the bubble vibrations. The results presented here show that we can determine the parameters of the bubbly liquid required for the maximization of a given frequency component of this component (high or low frequency range).

Abstract No.12

Classroom Acoustics: Low-cost Design Strategies for Classroom Acoustic Improvement

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The influence of classroom acoustics on students' learning attainment has been extensively explored over the years. Students encountered difficulties in speech comprehension as a result of unfavourable classroom acoustics conditions, which subsequently affected their cognitive development and academic performance. Therefore, optimal listening conditions are required to ensure that listeners perceive and recognize speech effectively. Classroom acoustic

guidelines have been established by various countries to uphold effective learning processes, and yet most classroom designs fail to comply. This invites numerous studies to explore plausible acoustic interventions and treatments as an initiative to remediate the issue. Thus, this study seeks to a) identify the actual acoustic conditions in two (2) classrooms in

the Faculty of Built Environment, Universiti Malaysia Sarawak, and b) establish economical acoustic treatment design strategies for future improvement. This quantitative study embarks on on-site acoustic measurements to evaluate the reverberation time and background noise level of the selected classrooms. The data from on-site measurement is applied for 3D model verification for the simulation process. The establishment of plausible design treatment alternatives is further analyzed through simulation using ODEON software. The simulation process yielded the effects of a) surface treatment and b) sound field amplification systems on several acoustic parameters. Outputs from this study are beneficial for the designers and end users in providing acoustically conducive classrooms for better educational outcomes that are in line with SDG3's good health and well-being and SDG4's quality education.

Abstract No.13

EXPERIMENTAL OF SOUND POWER MEASUREMENT: ISO CONVENTIONAL METHODS AND MEMS SPHERICAL ARRAY MICROPHONE COMPARISON

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Sound power level determines the actual performance or strength of a sound source, which can range from a portable loudspeaker to gigantic machinery. Methods to measure sound power have been introduced since the 80s by the International Organization for Standardization (ISO), determining sound power with sound pressure in ISO 3740 series. Later, ISO 9614 series were introduced with methods based on sound intensity. Both methods have been adopted and are well-known throughout the field. Nowadays, the technology of MEMS microphones is widely spread in the industry, as well as the method of

combining multiple microphones to form an array, allowing engineers to localize sound source location and capture multiple acoustic parameters simultaneously. This paper presents an experiment measuring sound power level with the RSS using conventional ISO methods from sound pressure and intensity known to be able to provide accuracy higher than survey grade, compared with a spherical array microphone that was more recently introduced. An in-situ measurement is also presented to experiment with the practicality of each method.

Theme areas: Acoustical and vibration measurement and instrumentation.

Abstract No.14

Study of Unstable Acoustic Wave Propagation Modes in the Presence of Flow and Absorbent Materials

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A large number of acoustic problems related to propagation in the guides. Waveguides in the form of duct walls are found in many industrial applications such as ventilation ducts, mufflers, aircraft turbojets. Waveguides can also present discontinuities related to obstacles so the walls can be covered with absorbent material. The walls duct is maintained with the addition of absorbent material to the fluid flow. Acoustic waves can be propagated in various modes by the vibrations of the particles. Acoustic waves spread mechanical energy through the medium. The objective of this research is to study the unstable acoustic propagation modes in

the presence of flow and absorbent materials. Both modes of unstable acoustic waves propagation deviate from the origin when the sum of the Mach numbers is low. Analysis of the high number of modes 200 shows two unstable modes clearly. The unstable acoustic wave propagation mode was found to be symmetrical at Cartesian coordinates in the fourth quadrant region is a negative imaginary complex area and the opposite in the second quadrant the positive real complex area. The evolution of the unstable mode can be found when the number of Mach numbers varies ($0.05 < M < 0.95$). The results show that there are always two unstable

modes in a flow and absorbent material. Unstable acoustic wave propagation modes can be eliminated by addition a lot of absorbent material so the Mach number approaches zero.

Keywords : Acoustic, modes, unstable, flow, absorbent