The 6th Meeting of the MidSouth Chapter of the Acoustical Society of America

The University of Central Arkansas Conway, AR 72034

March 12-13, 2010

Meeting Proceedings

Meeting Schedule:

Friday, March 12

1:00-2:00PM	:	Registration
2:00-3:15PM	:	Opening Session
3:15-3:30PM	:	Break
3:30-4:30PM	:	Afternoon Session
6:00-7:30PM	:	Dinner & Socializing Downtown

Saturday, March 13

7:30-8:30AM	:	Coffee & Donuts
8:00-9:45AM	:	Morning Session
9:45-10:15AM	:	Poster Session & Break
10:15-12:00PM	:	Closing Session
12:15-1:15PM	:	Exec. Committee Meeting

Meeting Location: The meeting will be held in Lewis Science Center located on Bruce Street on the University of Central Arkansas campus. Parking is available in the lots on the east side of the building. Sessions will be held in the south end of the building in room 101 with posters displayed in the atrium. Check the Chapter website for building and campus maps.

Announcements: The next meeting of the MidSouth Chapter of the Acoustical Society of America will be in the fall of 2010 in Oxford, MS.

Check the chapter website:

`http://www.acosoc.org/RegChapters/MidSouth/`

for more details about the upcoming meeting in the months ahead.

Oral Abstracts

FRIDAY AFTERNOON, 12 MARCH 2010

2:00-2:15 PM

Elastic Constants of Palladium Hydride at Elevated Temperature and Pressure. Rasheed Adebisi*, Guangyan Li, and Josh Gladden. (University of Mississippi, National Center for Physical Acoustics, 1 Coliseum Dr., University, MS 38677, raadebis@olemiss.edu)

The desire to have a fundamental understanding of metal-hydrogen systems and to explore this for possible technological applications has been the motivation of research of these systems. Hydrogen atoms occupy the octahedral interstitial sites provided by metals with FCC lattices (such as palladium). Palladium hydride (PdHx) exists in two phases. At room temperature, the low concentration (PdHx=0.02) called alpha phase, has slightly larger lattice parameter compared to that of pure palladium. Above this concentration and up to PdHx=0.6 the high concentration (beta) phase appears resulting in a mixed phase region and the lattice parameter becomes substantially greater than that of pure palladium. When $x > 0.6$ the alpha phase disappears. The two phases coexist at the critical temperature and pressure. Resonant Ultrasound Spectroscopy (RUS) has been used to investigate the elastic constants of palladium hydride crystal and the equilibrium dynamics of the system around the critical temperature and pressure. A large decrease in shear modulus is noticed near this critical point. This investigation includes the design and construction of high temperature and high pressure RUS cell.

2:15-2:30 PM

Acoustic Signature of Dopant Precipitation in the Thermoelectric Alloy Silicon Germanium. Guangyan Li*, Rasheed Adebisi, and Josh Gladden (University of Mississippi, 1 Coliseum Dr., NCPA Room 1077, University, MS 38655, gyli@phy.olemiss.edu)

The elastic moduli of several nanostructured polycrystalline silicon germanium (SiGe) alloys were measured over a wide temperature range of room-1173K using a high-temperature resonant ultrasound spectroscopy (RUS) apparatus. The abnormal stiffening in elastic moduli of phosphorus-doped (n-type) samples in the temperature range of 623-823K was observed. The stiffening occurred only upon initial heating, and was absent in the subsequent cooling and additional heatings. It is hypothesized that the abnormal stiffening was attributed to the change in the number of relatively weaker Si-P and Ge-P bonds and stronger Si-Si, Si-Ge and Ge-Ge bonds. The solubility limit of phosphorus in SiGe alloys is temperature dependent. At 623K upon heating, the phosphorus starts to precipitate out at the grain boundaries, and continues doing so until 823K. After that, the phosphorus starts to go back into solution due to the increased solubility. Upon cooling, similar precipitation process is repeated but a fraction of the dopant remains at the grain boundaries all the way down to room temperature, resulting in a slightly stiffer state. To further test the hypothesis, an n-type sample that had been heated twice was specifically treated at JPL by heating at 1275K for 30 minutes to ensure that most of the phosphorus was put back into solution. As predicted, this reprocessed sample showed the same elastic stiffening during a repeat of RUS measurements. The p-type samples doped with boron, whose solubility in SiGe is not temperature dependent, did not show any abnormal elastic stiffening upon heating.

2:30-3:00 PM

Aircraft Engine Components Vibrations Research. S. Midturi (Donaghey College of Engineering and Information Technology, The University of Arkansas at Little Rock, Little Rock, AR 72204, sxmidturi@ualr.edu)

The objective of this presentation is to describe experimental and analytical research to discover mechanisms that cause failures in turbine and compressor blades, and bladed disks of aircraft engines. Current

research to analyze and model aircraft engine components includes the development of efficient modeling and solving finite element and partial differential equations of motion of aircraft engine and aerospace components. Experimental research will include exploring non-invasive optical methods to validate analytical predictions. The measurement and quantitative interpretation of dynamic displacement patterns of rotating machine components is a difficult task. The methods used so far to acquire vibration data from rotating components are largely intrusive, and these sensors would affect mechanical properties of test components and the flow pattern around airfoils. Other limitations of intrusive measurement methods include limited data acquisition, low survivability of sensors under high g's and high temperatures, and inaccessibility for sensor installation. These limitations have opened the door for developing new noninvasive methods to measure vibrations of rotating engine components. The author's work conducted at the Aero Propulsion Laboratory of Wright Patterson Air Force Base is described here to highlight the analysis of modal response of a rotating bladed disk in laboratory conditions. This presentation will describe how double pulse holographic method in conjunction with motion compensation device has recorded the resonant response of spinning disks. The present thrust by NASA, DOE, and DOD to promote high temperature and high strength materials for advanced engines and aerospace vehicles have opened a new window of opportunity to develop analysis and measurement methods to characterize vibrations of aerospace structures and aircraft engine components. The author seeks collaborative opportunities in Arkansas to address noninvasive measurement applications to characterize multi-scale devices.

3:00-3:15 PM

Detection of Seismic/Infrasound Emissions from Convective Storms and Volcanoes. Bob Dunn (Hendrix College, Department of Physics, 1600 Washington Ave. Conway, AR 72032, dunn@hendrix.edu)

It is well established that convective storms and volcanoes can generate both seismic and infrasound waves. In this presentation, the seismic/infrasound signatures from select hurricanes and volcanoes detected by a ring laser interferometer will be discussed. The spectral responses from mature hurricanes appear inversely proportional to the vortex core diameter which is in agreement with several studies by NOAA on tornadoes. Observing corresponding satellite images adds credibility to this relation. Although volcanic emissions appear fairly often in the ring laser record, the variability in their infrasound spectra complicates the analysis. However, the peaks in the infrasound spectral responses of both hurricanes and volcanoes generally correlate with theoretically predicted atmospheric resonances.

3:15-3:30 PM
Break

3:30-3:45 PM

Mapping Environmental Noise Pollution: An Integrated Approach. Stephen DiGiacomo (Southwestern Energy, 23 Nabco Avenue, Conway, AR 72033, Stephen_DiGiacomo@SWN.COM)

The notion of environmental responsibility has produced an increased awareness about many pollutants as humans struggle to mitigate their impact on the planet. Environmental noise is one of the byproducts resulting from the expansion of human technology and transportation. While it is not usually understood as a pollutant, mitigating environmental noise has become a priority both for governing bodies and private organizations around the globe. Recent advancements in acoustic modeling and cartographic representation have provided better comprehension and problem-solving capabilities for mitigating noise pollution. The purpose of this presentation is to promote a better understanding of environmental noise pollution by briefly tracing its history, evaluating the medical and environmental ramifications of noise exposure, exploring the current possibilities in modeling noise in the geospatial environment, and providing analysis through the integration of noise modeling software and ArcGIS.

3:45-4:15 PM

LNG Compression Station Noise Monitoring and the LDN Metric. Bryce Docker (Acoustical Consulting, 1211 San Marcos Dr., Arlington, TX 76012, BryceDocker@gmail.com)

The use of horizontal and hydraulic fracturing drilling techniques now provides access to large reserves of natural gas which were previously unattainable. The increased domestic gas mining in the Southwest and Northeast regions of the United States will decrease foreign energy dependence while providing long term employment opportunities. The infrastructure and pipelines necessary to support the natural gas industry can negatively impact the environment. The negative environmental effects as outlined by the Federal Energy Regulatory Commission (FERC) can include excessive water use and contamination, wildlife impacts, cultural impacts, socioeconomic impacts, geological impact, soil contamination and air and noise quality. The impact on noise quality is the focus of this presentation. In the absence of local noise ordinances, new and existing compressor stations and all new Liquified Natural Gas (LNG) stations must comply with the FERC guidelines outlined in Title 18, Code of Federal Regulations Part 380.12 - Environmental Reports for Natural Gas Act applications. The FERC document defines the maximum permissible noise level as 55 LDN at any preexisting noise sensitive area (NSA) which includes schools, hospitals and residences. The following will discuss the measurement procedure and data analysis required to determine whether a LNG compressor station is in compliance per 380.12 (k) *Resource Report 9-Air and noise quality*. General data processing techniques as well as advanced techniques using instrumentation, such as the Brüel & Kjær Type 2250 Integrating Sound Level Meter, will be presented.

4:15-4:30 PM

Environmental Noise Impact of Urban Gas Well Drilling. Greg Bracci (Brüel & Kjær, 5189 Lake Creek Court, Frisco, TX 75035, greg.bracci@bksv.com)

Given the invention of horizontal gas well drilling within the past 10 years, many shales once thought impossible to reach are now among the highest producing natural gas wells. Using a horizontal drilling technique, gas companies are now able to drill in major urban areas where deposits were previously considered inaccessible. As with many technological advancements, there are drawbacks which must be considered when implementing new processes. In this case, the main objection is the unwanted noise caused by these urban drilling sites. Among the shales with the most urban drilling, many of them are located in North Texas, Louisiana, and Arkansas. Major US cities such as Ft. Worth, TX and Shreveport, LA, have put in place strict noise ordinances to regulate the unwanted noise from these sites. Instrument manufactures have also developed new technologies to help measure in these situations. In this discussion, new ordinances and technologies to ensure compliance of the ordinances and will be presented.

SATURDAY MORNING, 13 MARCH 2010

8:00-8:15 AM

Medical Applications of Ultrasound. Cecille Labuda (Department of Physics and Astronomy & The National Center for Physical Acoustics, University of Mississippi, University, MS 38677, cpembert@olemiss.edu)

Ultrasound has many medical applications; hemorrhage control, medical imaging and cancer treatment to name a few. While some of these applications are well established in the medical field, many are still under research and development. In this talk, I will discuss some of the newer applications of medical ultrasound and how they work. In particular, I will discuss my research in the area of high intensity focused ultrasound for hemorrhage control, the physical challenges limiting this technology and how these challenges may be overcome.

8:15-8:30 AM

Optimal spatial averaging for ultrasonic backscatter measurements of bone. Brent Hoffmeister (Rhodes College, 2000 North Parkway, hoffmeister@rhodes.edu)

Ultrasonic techniques are being developed to detect changes in bone density caused by osteoporosis. We have proposed that ultrasonic backscatter measurements may be useful for this purpose. Phase cancelation effects and the natural inhomogeneity of bone tissue can cause backscatter signals to vary significantly from site to site in a measurement region. For this reason, it is useful to average measurements from several different sites. The goal of this study is to determine the optimal amount of spatial averaging. Measurements were performed on two specimens of bone with different densities using five different ultrasonic transducers ranging in center frequency from 1 to 10 MHz. We find that several hundred measurements may be required to obtain a stable spatially averaged measurement for a 1 x 1 cm region of bone. Interestingly, the optimal amount of spatial averaging does not appear to depend strongly on the density of the bone specimen or the type of transducer.

8:30-8:45 AM

7T MRI-guided Focused Ultrasound Delivery in Small Animals. Xin Chen*, Eduardo G Moros, Terri Lynn Alpe, Nathan A Koonce,Gal Shafirstein, Robert J. Griffin, and Peter Corry (University of Arkansas for Medical Science 4301 W. Markham Street #771, Little Rock AR , xchen@uams.edu)

To develop and evaluate a method for delivery focus ultrasound energy to small animals inside a 7T magnet (Bruker-Biospin) for preclinical studies a MRI-compatible spherically-focused PZT-4 ultrasound applicator was fabricated with an aperture of 3.8 cm in diameter, an f-number of 1.3, and a resonant frequency of 2.25 MHz. The transducer was designed using acoustical and thermal modeling. A GPU-based multithread parallel computation was conducted to rapidly calculate the pressure fields. The MRI structural and temperature imaging (7T-MRIT) based on the proton resonance frequency (PRF) shift method was devised to capture the temperature dynamics in the tissue during focus ultrasound. A series of MRI-guided focused ultrasound exposures were conducted in polyacrylamide gel phantom, excised chicken muscle and dead mice. In vivo testing with respect to the motion suppression and heating dynamics is in progress. The following issues were evaluated experimentally: (1) image quality (signal-to-noise ratio); (2) accuracy of temperature measurement; (3) phase unwrapping algorithm; (4) heating characterization of the fabricated ultrasound transducer. In conclusion a method for 7T-MRI-guided focused ultrasound exposures in small animals was developed and tested. The method is a powerful tool for ultrasound/thermal preclinical studies since ultrasound/heat can be delivered noninvasively to small volumes in small animals while detailed temperature distributions can be measured. [Work supported by: Central Arkansas Radiation Therapy Institute, NCI R01 CA044114, NCI 3 R01 CA044114-19S1 and 1 RC1 CA147697-01.]

8:45-9:00 AM

The Transducer Design Considerations of SonoKnife for Superficial Large-size Tumor. Rongmin Xia*, Duo Chen, Eduardo Moros, Xin Chen, Gal Shafirstein and Peter Corry (Department of Radiation Oncology, University of Arkansas for Medical Science, rxia@uams.edu)

It is well known that High Intensity Focused Ultrasound (HIFU) can treat cancer via thermal ablation as evidenced by its past and present clinical use in several countries. The main disadvantage current HIFU systems and techniques have is the long treatment times necessary to treat even relatively small tumors. To address this and other disadvantages we propose the development of a HIFU device having an acoustic edge (instead of a focal point created by spherically focused transducers), namely, a SonoKnife, a scan-able line-focused transducer to deliver thermal ablation (52-60°C) to superficially located tumors or malignant nodes. In comparison to a spherically focused transducer, the SonoKnife should be able to treat larger tissue volumes in less time. In addition, because it produces lower intensities other potential problems like nonlinear propagation and cavitations are ameliorated. Based on preliminary simulation results, a prototype cylindrical section transducer operating at 3 MHz, with a 60 mm radius of curvature, an altitude of 30 mm and divided into 10 equally sized elements along the transducers altitude is constructed for laboratory testing. The overall rationale and design of a SonoKnife will be presented as well as preliminary numerical results. [Work supported by: NCI RC1 CA147697 and the Central Arkansas Radiation Therapy Institute (CARTI).]

9:00-9:15 AM

Numerical Characterization of the SonoKnifes Acoustic Edge. Duo Chen*, Eduardo Moros, Rongmin Xia, Xin Chen, Gal Shafirstein and Peter Corry. (Department of Radiation Oncology, University of Arkansas for Medical Sciences, dchen2@uams.edu)

A SonoKnife is a novel thermal therapy concept; it is a cylindrical ultrasound transducer composed of a single element or multiple elements (an array). Its cylindrical geometry generates a a line-focused or acoustic edge. It is being developed for non-invasive thermal ablation of advanced head and neck tumors and nodes. Line-focusing has advantages over the more common "point"-focusing of spherical radiators such as lower acoustic intensities in tissues (which minimizes nonlinear propagation and cavitation) and faster coverage of a target volume by scanning the line-focus. A clinical SonoKnife could include sufficient cooling of the coupling medium to protect cutaneous tissues. Acoustic simulations were performed to characterize the line-focus (or acoustic edge) and optimize the basic design parameters: size and f-number of the transducer, depth of the line-focus, frequency, and coupling material thickness. Simulations were generated using FOCUS (`http://www.egr.msu.edu/focus-ultrasound`), which is a free access software package for numerical modeling of ultrasonics for therapy and imaging. The shape and size (volume) of the focal region as a function of the basic design parameters were obtained. The minimum radiating surface area of several transducer designs that guarantee sufficient energy for thermal ablation was determined for a range of potential tumor sizes and locations. The simulation results show how the size of the focal region decreases with increasing frequency and increasing aperture. Simulations also indicate that increasing the depth of the line-focus will increase the size of the focal region. Spatial peak intensities were compared to spherically focused radiators of equivalent surface area. [Work supported by: NCI RC1 CA147697 and the Central Arkansas Radiation Therapy Institute (CARTI).]

9:15-9:30 AM

Optimizing Microbubble-Ultrasound Interactions for Maximal Sonothrombolysis In Vitro. M. J. Borrelli*, L. J. Bernock, E. Hamilton, J. Wu, and W. C. Culp. (Department of Radiology, University of Arkansas for Medical Sciences, 4301 West Markham Street #556, Little Rock, AR. 72205, MJBorrelli@uams.edu)

The purpose of this research is to establish the optimal ultrasound parameters (intensity, frequency, duty cycle, etc.) required to maximize in vitro sonothrombolysis (% clot mass loss/min) for different diameter microbubbles (0.5-10μm), and determine if inertial or stable cavitation is prevalent during sonothrombolysis for each optimized ultrasound-microbubble combination. Uniformly sized, albumin-dextrose microbubbles were produced, and the mean diameter for different preparations ranged from 0.5-10μm. Clots formed from fresh rabbit blood (3 h, 24 h, or 72 h old) were placed into a mylar chamber into which microbubbles were infused at a constant rate. The chamber was vertical in a tank filled with degassed water and insonated with ultrasound (delivered horizontally) at 1 MHz, 2 MHz, or 3 MHz. Different acoustic intensities from 0.1 W/cm^2 2.0 W/cm^2 were tested using either continuous or pulsed wave (5% to 70% duty cycle) ultrasound. Sonothrombolysis efficacy was measured as the percent loss in clot mass per minute of insonation. Effective sonothrombolysis was achieved using microbubbles with diameters be-tween 1.0-5 m. Maximal clot lysis occurred when the ultrasonic frequency was closest to the microbubbles' resonant frequency (e.g. 1 MHz for 1 μm microbubbles) and using the highest intensity that did not destroy the microbubbles. When ultrasound destroyed the microbubbles (inertial cavitation) the sonothrombolysis rate decreased sharply. Pulsed ultrasound with a duty cycle of 3-5% was most effective for sonothrombolysis. Increasing duty cycle did not improve clot lysis and ultimately reduced it when microbubble destruction occurred. Stably cavitating microbubbles yielded maximal, in vitro sonothrombolyis while inertial cavitation was ineffective. Because pulsed ultrasound with shorter duty cycles (3-5%) yielded maximal sonothrombolysis it is concluded that microbubble-ultrasound interactions during the earliest portions of a pulse were most effective for sonothrombolysis. Thus, a higher number of shorter duration ultrasonic pulses should yield more effective sonothrombolysis.

9:30-9:45 AM

Effect of Respiratory Anatomy on Expiratory Airflow and Acoustics in Human Nasal Airways. Jinxiang Xi* (Department of Systems Engineering, University of Arkansas, Little Rock, AR, jxxi@ualr.edu), Xiuhua Si (Department of Engineering, Calvin College, Grand Rapids, MI), JongWon Kim (Department of Applied Science, University of Arkansas, Little Rock, AR)

The intricate anatomy of the respiratory tract is believed to induce complex flow characteristics during exhalation before the air enters the nasal airways. However, this upstream effect on breathing resistance and sound production remains largely un-quantified within the upper respiratory airway. Specially, we hypothesize that the airway constriction due to the hanging uvula is one major cause that initiates flow instabilities and sleep disorders. The objective of this study is to systematically assess the effect of the larynopharyneal anatomical details on the expiratory airflow and acoustic characteristics in human nasal airways by means of numerical methods. To achieve this objective, a physiologically realistic extrathoracic airway was developed that extends from the nasal nostrils to the upper trachea based on human medical images. Both Reynolds Stress Model (RSM) and Large Eddy Simulations (LES) were employed to simulate the laminar, transitional and fully turbulent flow regimes for a spectrum of flow rates covering 4 - 45 L/min. We found large effect from the laryno-pharyngeal geometries on the exhaled airflows that enter the nasal cavity. In particular, the variation of the uvula position may significantly alter the breathing resistance. Abrupt pressure drops has been observed to result from the uvula-related airway obstruction when the human subject takes a supine position. Results of this study indicate that the uvula position is a major cause for sleep disorders such as snoring or obstructive sleep apnea syndrome.

9:45-10:15
Break & Poster Session

10:15-11:00 AM

Effect of Aging and Noise on Brainstem Responses to Speech. Samuel Atcherson (University of Arkansas at Little Rock & University of Arkansas for Medical Sciences, 2801 S. University Ave, Little Rock, AR 72204, sratcherson@ualr.edu)

The scalp-recorded speech-ABR has the ability to mimic the acoustic characteristics of the speech signal with remarkable fidelity (Johnson, Nicol, & Kraus, 2005). In the last few years, several investigators have honed the application of using consonant-vowel speech sounds to study how the auditory brainstem and cortex handles the acoustic characteristics associated with speech (Abrams, Nicol, Zecker, & Kraus, 2006; Cunningham, Nicol, King, Zecker, & Kraus, 2002; King, Warrier, Hayes, & Kraus, 2002; Russo, Nicol, Musacchia, & Kraus, 2004). Using the stimulus /da/ ("dah"), the resulting auditory brainstem response reveals a transient neural pattern to the stop-release of the consonant and a periodic neural pattern to the onset and formant transitions of the vowel. When this stimulus is presented in background noise in normally-hearing listeners, the morphology of the transient neural response has been shown to be highly compromised, while the periodic neural response remained temporally stable and easily identifiable (Russo et al., 2004). In aging adults, Burns et al. (2009) showed no difference between young and older adults when this stimulus is presented in quiet. Given that we are not entirely certain at this time why older adults have difficulty understanding speech in less-than-ideal listening environments, we hypothesize 1) that there is an age-related change in the ability of the brainstem to accurately mimic the speech stimulus, and 2) that the speech-ABR to speech in noise becomes increasingly degraded across the adult lifespan. Data has been collected to date on young and middle aged adults.

11:00-11:15 AM

Estimates of human cochlear compression from distortion-product otoacoustic emission input-output functions and tone detection. Shaum Bhagat (The University of Memphis, School of Audiology and Speech-Language Pathology, 807 Jefferson Avenue, Memphis, Tennessee 38105, sbhagat@memphis.edu)

It is widely accepted that the living and physiologically intact mammalian basilar membrane responds to increasing levels of acoustic input by compressing its mechanical output at fixed locations across the cochlear partition. Proposed methods of indirectly studying basilar membrane compression in humans include examination of distortion-product otoacoustic emission (DPOAE) input-output functions and masking functions obtained with on- and off-frequency maskers. Previous studies [Dubno et al., 2007; Horwitz et al., 2007] fit masking functions with a three segment regression model and found correlations between estimates of compression thresholds and thresholds for tones obtained in the quiet. The purpose of this study was to examine if compression estimates from the three segment model applied to DPOAE input-output functions would be correlated to thresholds for tones. DPOAE input-output functions and tone thresholds were measured in sixteen normal -hearing adults at two test frequencies (1000 and 2000 Hz). The DPOAE input-output functions were acquired for L2 levels from 45-70 dB SPL in 5-dB steps and tone thresholds were measured with a two-interval forced-choice procedure. Estimates of compression threshold were derived from the three segment model in each subject. The results indicated that compression thresholds were significantly correlated with tone thresholds at 2000 Hz, but no significant correlations were observed at 1000 Hz. These results will be discussed with regards to previous psychophysical findings and theories of DPOAE generation.

11:15-11:45 AM

Overview of Binaural Hearing. Laura Smith-Olinde (University of Arkansas at Little Rock & University of Arkansas for Medical Sciences, Little Rock, AR 72204, LSO@uams.edu)

Binaural hearing refers to the use of information derived from the receipt of and comparison between aural input to both ears. Many animals (e.g., mammals, birds) rely on binaural hearing for everyday activities such as sound source localization. In addition to sound source localization, binaural hearing provides humans: (1) the ability to engage the cocktail party listening mode, the ability to focus on a signal of interest (e.g., speech, music, musical lyrics) in the presence of background noise(s); and (2) increased perception of loudness, which may ease the detection of signals. In this presentation information on the anatomic and physiologic underpinnings of binaural hearing will be presented, including the peripheral, brainstem and cortical audiologic areas. Additionally, data from several psychoacoustic experiments will be presented which describe practical functioning of the binaural system. Finally, data from listeners with hearing loss will be presented which describe how binaural listening can be affected in these individuals.

11:45-12:00 PM

Development and evaluation of an acoustic device to estimate size distribution in catfish production ponds. John D. Heffington*, James P. Chambers and Bradley Goodwiller (University of Mississippi, The National Center for Physical Acoustics, University, MS 38677, jdheffin@olemiss.edu)

With increasing seafood demand, aquaculture is poised to become a major growth industry in the United States. In particular, channel catfish represents an approximately $400 million per year industry. Pond management strategies, however, are compromised by high fish densities with large size distributions that result from years of continuous culture without a total harvest. Recent work has been presented on the Aquascanner SONAR system, which evaluates the total population of the pond but is less effective in determining the size distribution. To address this shortcoming, research colleagues at the University of Arkansas Pine Bluff are using a subsample seine net. Their method involves pulling a trawl across the pond to obtain a sample of the fish and manually weighing the fish in a time-consuming process to provide the size distribution. The work presented here attempts to use acoustic backscatter to determine the size distribution of the fish in lieu of the manual weight measurements. After being seined, the fish are allowed to swim back into the pond through a restrictive pipe and are pinged acoustically to determine their target strength and thus size. The experimental design of the system and results will be discussed. [Work Supported by the USDA, SRAC.]

Poster Abstracts

Ultrasound Evaluation of Human Motion. Joshua Lieblong* and Carl Frederickson (Department of Physics, The University of Central Arkansas, Conway AR 72035, jal21387@yahoo.com)

Doppler ultrasound is being evaluated as a tool for characterizing human motion. A high frequency sound wave is transmitted toward a moving object, which then reflects frequencies shifted from the transmitted frequency due to the velocity of the object. A physical pendulum has been used to model the behavior of a leg. The prototype apparatus of the previous experiments is being examined to minimize the "overshoot" found. After the interaction between the acoustic signal and a single physical pendulum is understood, double physical pendulums can be compared to a person's gait. The comparison can be used to model an individual's walk to distinguish that person's mood, mass, or even a type of identification system for oscillatory human motion.

Behavior of a Helmholtz Resonator Driven at High Amplitudes. Dustin Morris* and William V. Slaton (Department of Physics, The University of Central Arkansas, Conway AR 72035, dustin.morris87@gmail.com)

The acoustic behavior of a Helmholtz resonator was studied when driven by a compressed air source. The resonator consists of a 55 gallon drum with 4-inch diameter necks of different lengths. Compressed air from a 0-15 psi regulator is introduced into the resonator using an electronic valve controlled by a signal generator. A pressure sensor was used to study the acoustic behavior of the resonator as it was driven over the resonance frequency with the compressed air source. By closely examining the resonant peaks, the quality factor of the system could be determined for different drive pressures and resonance frequency. The measured resonance frequencies are compared to two theoretical models. The resonator's quality factor (energy stored in resonance / energy lost per cycle) is shown to decrease with drive amplitude indicating increased losses with higher amplitude.

The Effect of a Helmholtz Resonator's Neck Geometry on the Aero-Acoustic Excitation of Resonance. Asami Nishikawa* and William V. Slaton (Department of Physics, The University of Central Arkansas, Conway AR 72035, asami.nishikawa@gmail.com)

The aero-acoustic excitation of a Helmholtz resonator with different neck geometries has been examined with an improved measurement technique. A Helmholtz resonator consists of a volume connected to a duct and has a well defined resonance frequency which depends on the length of the duct, the volume of the resonator and the cross-sectional area of the duct. In the system used during this experiment, two Helmholtz resonators have been positioned at opposite sides of a junction in a wind tunnel. The air speed in the wind tunnel can be varied over the range 0 to 28 m/s. The air flowing over the junction openings to the Helmholtz resonators can excite the acoustic resonance of the system. This is similar to blowing over an empty bottle's opening and creating a tone. The excitation of the resonator as a function of flow speed in the wind tunnel has been recorded. The effect of the resonator's geometry has been seen in the measured acoustic amplitude and frequency in the resonator and will be presented.