Seabed Properties from Acoustic Reflection Measurement: An experiment in the Mediterranean

Friday, January 25, 2013 4:00 p.m. in ETC 4.150

Nicholas P. Chotiros and Marcia J. Isakson
Applied Research Laboratories
The University of Texas at Austin
http://www.arlut.utexas.edu

The seabed is often modeled as a fluid, visco-elastic solid, or water-saturated poro-elastic material. Using experimental measurements from a sandy seabed, it is shown that the poro-elastic model can fit the measured reflection data better than the other models. Roughness scattering had a significant effect on the measurements requiring a more sophisticated roughness model than Eckart scattering. Reflection loss and roughness measurements were taken at the Experimental Validation of Acoustic Models experiment in 2006 (EVA-06), off the Isola d'Elba, Italy, in collaboration with the NATO Undersea Research Centre. The magnitude and phase of the reflection loss were measured at frequencies from 5 to 80 kHz and grazing angles from 7 to 77 degrees. Approximately 1500 samples were taken at each angle. The roughness was measured with a laser profiler. The measurements were compared with model predictions. The material is based on [M. J. Isakson, N. P. Chotiros, R. A. Yarbrough, and J. N. Piper, "Quantifying the effects of roughness scattering on reflection loss measurements," J. Acoust. Soc. Am., Vol. 132, pp. 3687-3697, 2012].

Recent Advancements in Research and Commercialization of Tethered Encapsulated Bubbles for Low-Frequency Underwater Noise Abatement

Friday, February 1, 2013 4:00 p.m. in ETC 4.150

Dr. Kevin M. Lee
Applied Research Laboratories
The University of Texas at Austin
http://www.arlut.utexas.edu/

Dr. Mark S. Wochner
AdBm Technologies, LLC
http://adbmtech.com

Arrays of large encapsulated bubbles have been shown to be very effective at reducing underwater sound radiated from various sources. These arrays provide noise reduction using the combined effects of bubble resonance attenuation and acoustic impedance mismatching and have been used to treat both sources of noise and to protect receiving areas from external noise. Recent research efforts at UT concerning the acoustics of large encapsulated bubbles and their use in reducing underwater noise will be presented. Measurements of encapsulated bubble resonance frequencies and attenuation were made and compared with various bubbly liquid effective medium models for the purpose of determining which models are best suited for designing future systems. Additionally, experiments were conducted in which encapsulated bubble arrays were used to reduce underwater noise from both continuous and impulsive noise sources. The research has also resulted in a UT spin-off company, AdBm Technologies, which was formed in 2012 and is currently commercializing the technology as well as sponsoring UT research aimed at developing prototype noise abatement systems. The process of technology commercialization at UT and the transition from idea to salable product will be detailed.

Non-Contact Acoustic Excitation and Sensing for Nondestructive Testing of Concrete Structures

Friday, February 8, 2013 4:00 p.m. in ETC 4.150

Professor Jinying Zhu and Xiaowei Dai
Department of Civil, Architectural and Environmental Engineering
The University of Texas at Austin
http://www.caee.utexas.edu

Aircoupled sensing has shown great potential for rapid nondestructive sensing and scanning of concrete infrastructure. However, the current aircoupled sensing method has two limitations: (1) the aircoupled sensor (a microphone) has low sensitivity, which results in low signal-to-noise ratio (SNR) for testing in the field and (2) a mechanical contact impact source is needed to excite elastic waves in concrete. In this presentation, we present a fully air-coupled acoustic excitation and sensing system to address these challenges. To improve the SNR, a parabolic reflector is used to focus the incident plane wave radiated from the concrete specimen, and a microphone located at the focal point of reflector receives the amplified signals. An analytical solution has been derived to optimize the geometry of the reflector for this purpose. Experimental studies and finite element simulations validate the improved sensitivity and SNR. To realize noncontact excitation, an acoustic spark source with an ellipsoidal reflector has been proposed to excite wave motion in concrete. Analogous to shock wave lithotripter devices, the spark is located at the near focus and generates an outgoing wave that is then focused at the far focus of the reflector which is aligned at the air-concrete interface. Applications of the air-coupled system for Rayleigh wave, zerogroup velocity Lamb wave (impact echo) and through transmission tests on a concrete slab are presented.

Modeling Acoustic Scattering and Propagation with Elastic Bottoms Using Finite Elements

Friday, February 15, 2013 4:00 p.m. in ETC 4.150

Dr. Marcia J. Isakson and Dr. Nicholas P. Chotiros
Applied Research Laboratories
The University of Texas at Austin
http://www.arlut.utexas.edu

Acoustic interaction with the ocean bottom is a critical part of understanding propagation in shallow water environments. However, most ocean propagation models consider the seafloor as flat or use approximations to determine the effects of scattering from the rough interface. Each of these approximations has a range of validity which is generally unknown for layered or elastic bottom types with realistic roughness conditions. Elastic bottoms present a unique challenge since scattering from rocky or hard bottoms often produces an interface wave which is not captured in many of the approximations. Finite element analysis provides a useful benchmark for these models since it approaches an exact

solution to the Helmholtz equation as the discretization density increases. In this study, finite element models will be compared with perturbation theory and the Kirchhoff approximation for rough elastic bottoms. These results will be used to compute reflection and backscattering coefficients for areas with rocky seafloors.

Micromachined Piezoelectric Energy Harvesters

Friday, March 1, 2013 4:00 p.m. in ETC 4.150

Donghwan Kim
Department of Electrical & Computer Engineering
The University of Texas at Austin
http://www.ece.utexas.edu

Small-scale piezoelectric energy harvesters (PEH) have been the subject of recent investigations. Previously the power output of MEMS PEHs was considered too small to operate a sensor, but advances in lowering the power demands of small, unattended sensors make PEHs attractive as a power source. The opportunity to create a maintenance-free remote sensor network is attractive for many applications, including intrusion detection systems and structural health monitoring. Fundamentally, a PEH utilizes ambient vibration input so that the piezoelectric element on the harvester deforms and produces power. This technique is most effective near the PEH's fundamental resonance frequency due to large mechanical deformations. As one might expect, power output is also proportional to resonance quality factor Q. Cantilever geometries are popular for this reason. Designing for maximum power capture at resonance by using highQ resonant devices comes at the expense of reducing the PEH's effectiveness off-resonance. To overcome this, a broadband harvester innovation is proposed. This presentation will include microfabrication of single-mode piezoelectric cantilever test structures comprised of 20μmthick silicon beams with bulk silicon tip masses. The beams are fabricated with 1μmthick lead *zirconate titanate* (PZT) films along their top surface. Testing results are also presented and include demonstration of impedance matching and theoretical maximum power capture. A discussion of preliminary design considerations for upcoming broadband harvesters is also included.

Modeling of Microfluidic Acoustophoretic Motion of Cells and Particles for Identification of Vibro-Acoustic Properties

Friday, March 8, 2013 4:00 p.m. in ETC 4.150

Professor Yong-Joe Kim
Department of Mechanical Engineering
Texas A&M University
http://www.mengr.tamu.edu

Microfluidic, acoustophoretic cell/particle separation has gained significant interest recently. In order to analyze the motion of cells/particles in the acoustophoretic separation, a one-dimensional (1-D) analytical model in a "static" fluid medium has been widely used, while the effects of acoustic streaming, viscous boundary layers, and 2D and 3D geometries are usually not considered. Therefore, it is not sufficient to accurately predict the cell/particle motion. Thus, a numerical modeling procedure for analyzing the acoustophoretic microparticle motion in microfluidic channels is presented to include the aforementioned effects. Here, the mass and momentum conservation equations and the state equation are decomposed into zeroth, first, and second-order governing equations by using a perturbation method. Then, zeroth, first, and second-order acoustic fields are calculated by applying a sixth-order finite difference method to the decomposed governing equations. The acoustophoretic force calculated by integrating the acoustic

pressure over the surface of a rigid microparticle along with viscous drag force is then applied to the Newton's equation of motion to analyze the acoustophoretic motion of the microparticle. Since the acoustophoretic motion depends on the vibro-acoustic properties (e.g., density, compressibility, and size) of particles/cells, the vibro-acoustic properties can be estimated by optimally fitting the experimental and simulated trajectories. The properties obtained from experimental results with polystyrene beads and cancer cells show good agreement with the data reported in literature.

The Acoustics of Multiphase Materials in the Shallow Water Ocean Environment

Friday, March 29, 2013 4:00 p.m. in ETC 4.150

Professor Preston S. Wilson
Applied Research Laboratories
Department of Mechanical Engineering
The University of Texas at Austin
http://www.arlut.utexas.edu

The shallow water ocean environment can be quite complicated acoustically, in part due to the abundance of multiphase materials, such as air bubbles in water near the ocean surface, water saturated granular sediments, gas-bearing sediments and gas-bearing vegetation on the ocean bottom, and swim bladder fish in the water column. Successful operation of sonar in this environment requires knowledge of the acoustic properties of these materials. The basic physics of sound propagation in these materials will be discussed and results from a variety of laboratory and field experiments will be presented. The success and failure of various models that attempt to predict the acoustic behavior of these materials will also be discussed. Finally, a proof-of-concept sonar system will be described that exploits the nonlinear acoustic properties of bubbly liquids to distinguish bubble clouds from more rigid targets. [Work supported by ONR and ARL:UT IR&D.]

Gigahertz Opto-Acoustics using Guided-Wave Nanophotonics

Friday, April 12, 2013 4:00 p.m. in ETC 4.150

Professor Zheng Wang
Department of Electrical & Computer Engineering
The University of Texas at Austin
www.ece.utexas.edu

Coherent acoustic waves at ultrahigh frequencies (5100 GHz) promise a wide range of on-chip applications, from microwave signal buffering/processing to nanoimaging. We produce such ultrahigh frequency acoustic waves using guided wave nanophotonic structures that strongly couple optical signals with acoustic signals. We explore nanostructures capable of maximizing coherent acoustic phonon generation through a combination of radiation pressure and electrostriction. Experimental observation of such optoacoustic effects in silicon waveguides, manifests as stimulated Brillouin scattering, producing radically enhanced and tailorable third order nonlinearities.

Biomedical Applications of Acoustics

Friday, April 19, 2013 4:00 p.m. in ETC 4.150

Dr. Armen Sarvazyan
Artann Laboratories, Inc.
www.artannlabs.com

In this presentation, a wide range of topics related to biomedical applications of acoustics, ranging from diagnostic imaging and biosensors to ultrasound-enhanced drug delivery and time-reversed acoustics, will be demonstrated. For example, Artann Laboratories has developed a family of ultrasonic devices for assessment of bone health and diagnosis of diseases of the skeletal system. The fundamental difference between Bone UltraSonic Scanner™ (BUSS) developed in Artann and existing bone ultrasonometers lies in the use of multiple modes of acoustic waves generated in a wide frequency range thus resulting in multiparametric characterization of bone conditions. In addition to osteoporosis, BUSS could be used in pediatric bone growth monitoring, drug-induced bone deterioration, assessment of bone health in sports medicine, monitoring condition of skeletal system of astronauts during long-term space missions, and veterinary medicine. Another ultrasonic technology developed in Artann is related to monitoring body hydration level which is critical in maintaining both physical and cognitive health. Body water weight loss—dehydration—impairs abilities and can lead to severe health problems, even death. The Hydration Monitor (HM) is based on correlation of tissue molecular composition and acoustic properties. Specifically, the ultrasound velocity in the soft tissue is a linear function of the tissue water content. Because muscle provides the largest body reservoir for water, the assessment of water imbalance is conducted by measuring speed of ultrasound in muscle. A prototype of HM was extensively tested in animal tissues in vitro, and in human studies involving adult patients with lower limb edemas and athletes during acute dehydration and rehydration. One of the hottest areas in medical imaging is tissue elastography. Two recent volumes of Current Medical Imaging Reviews (Specials issues on hot topics) were devoted to Elasticity Imaging (EI), which is an area of major activities in Artann. Artann developed several modalities of EI, licensed them to several companies and holds about 20 USA patents related to EI. One of such EI technologies licensed to a French company SSI is Shear Wave Elasticity Imaging (SWEI) – a method of tissue elasticity assessment and visualization. In SWEI, the radiation force of focused ultrasound remotely induces localized shear waves, which are visualized by ultrasonic or MRI methods in order to assess tissue elasticity. Several other innovative projects of Artann, such as medical and industrial applications of the Time Reversal Acoustics and Ultrasound Particle Agglutination method for the detection of human immunodeficiency virus (HIV) antibody in body fluids, will be presented. The presentation will conclude with the discussion of current and future trends in these and other biomedical acoustic technologies.

Acoustics from High-Speed Jets with Crackle

Friday, April 26, 2013 1:00 p.m. in ACES 4.304

Woutijn J. Baars
Department of Aerospace Engineering
The University of Texas at Austin
http://www.ae.utexas.edu

A scaling model based on the Gol'dberg number is proposed for predicting the presence of cumulative nonlinear distortions in acoustic waveforms produced by high speed jets. Two acoustic length scales, the shock formation distance and the absorption length are expressed in terms of jet exit parameters. This approach allows one to compute the degree of cumulative nonlinear distortion in full-scale scenarios, from laboratory-scale observations, or vice versa. Surveys of the acoustic pressure waveforms emitted by a laboratory-scale, shock free and unheated Mach 3 jet are used to support model predictions. These acoustic waveforms are acquired on a planar grid in an acoustically treated and range-restricted environment. Various statistical metrics are employed to examine the degree of local and cumulative nonlinearity in the measured waveforms. This includes skewness, kurtosis, the number of zero crossings in the waveform, a wave steepening factor, the Morfey-Howell nonlinearity indicator and an application of the generalized Burgers' equation.

Based on findings of the model and the spatial topography of the metrics, it is concluded that cumulative nonlinear steepening effects are absent in the current data set. This implies that acoustic shock-structures in the waveforms are generated by local mechanisms in, or in close vicinity to, the jet's hydrodynamic region. Furthermore, these shock-structures induce the crackle noise component. The research aims to quantify crackle in a temporal and spectral fashion, and is motivated by the fact that (1) it is perceived as the most annoying component of jet noise, (2) no unique measures of crackle exist, and (3) significant reductions in jet noise will be achieved when crackle can be controlled. A detection algorithm is introduced which isolates the shock-structures in the temporal waveform that are responsible for crackle. Ensemble-averages of the identified waveform sections are employed to gain an in-depth understanding of these structures. Moreover, PDF's of the temporal intermittence of these shocks reveal modal trends and show evidence that crackling shock-structures are present in groups of multiple shocks. A spectral measure of crackle is considered by using wavelet-based time-frequency analyses. The increase in sound energy is computed by considering the global pressure spectra and the ones that represent the spectral behavior during instances of crackle. This energy-based metric is postulated to be an appropriate metric for the level of crackle.

The Prediction and Reduction of Jet Noise from Tactical Fighter Aircraft

Friday, April 26, 2013 4:00 p.m. in ETC 4.150

Professor Philip J. Morris
Department of Aerospace Engineering
The Pennsylvania State University
http://www2.aero.psu.edu/morris

The noise generated by modern tactical fighter aircraft can cause noise-induced hearing loss in personnel located near the aircraft and annoyance in communities surrounding military bases. This is a special problem for the Navy as both landing and takeoff involve high power engine settings and personnel on a carrier deck are located very close to the aircraft. The jet noise generated by the hot supersonic jet exhausts involves two source mechanisms. The dominant noise is turbulent mixing noise generated by

the supersonic convection of the large turbulent structures in the jet exhaust. This generates the highest levels and radiates in the downstream arc. The interaction of the turbulence with shock cells in the jet plume results in broadband shock-associated noise. This is important at larger angles to the jet downstream axis. This talk will describe different ways to predict these two noise sources and their radiation. Broadband shock-associated noise is predicted on the basis of an acoustic analogy and steady Reynolds averaged Navier-Stokes simulations. The mixing noise is predicted using unsteady Navier-Stokes simulations coupled to an acoustic analogy for wave extrapolation to a far field observer. Finally, a new method to reduce the strength of these jet noise sources is described. Results of simulations and experiments to demonstrate the effectiveness of this noise reduction method will be given.

Finite Element Modeling of Acoustic Scattering from Fluid and Elastic Rough Interfaces for Ocean Acoustics Applications

Friday, September 6, 2013 4:00 p.m. in ETC 4.150

Dr. Marcia J. Isakson
Applied Research Laboratories
The University of Texas at Austin
http://www.arlut.utexas.edu

Quantifying acoustic scattering from rough interfaces is critical for ocean acoustic applications, especially in shallow water waveguides. In this scenario, the sound has many interactions with both the air/water interface and the sediment/water interface. Scattering from these interfaces both reduces the coherent reflected component of the sound as well as produces reverberation. The air/water interface is often modeled as pressure release while the sediment/water interface must be modeled as penetrable. Depending on the sediment, it can be modeled as a fluid, visco-elastic solid or poro-elastic solid. This study concentrates on the sediment/water interface by modeling both a fluid-like sediment and a visco-elastic solid. Historically, scattering is quantified by approximations to the Helmholtz/Kirchhoff integral. The two main approximations used are the Kirchhoff approximation and perturbation theory. The Kirchhoff approximation considers scattering as reflections from planes tangent to the facets of the surface. Perturbation theory expands the scattered pressure in a Taylor series with respect to the relief of the surface and truncates the series. Although these approximations are used extensively, there has not been a systematic study of validity especially for realistic rough surfaces. In this study, the finite element model results for scattering from fluid and visco-elastic solids with rough interfaces will be compared to the approximate methods. The results illustrate the role of the waves excited at the interface in the scattering process.

Hyundai Uses a LabVIEW-Based Portable Sound Camera for Buzz, Squeak, and Rattle Studies

Friday, September 13, 2013 4:00 p.m. in ETC 4.150

Kurt Veggeberg
Business Development Manager, Sound and Vibration
National Instruments
Austin, Texas
http://www.ni.com/soundandvibration
http://sine.ni.com/cs/app/doc/p/id/cs-15675

Acoustic beamforming involves mapping noise sources using an acoustical array. It discerns the direction from which the sound originates by the time delays that occur as the sound passes over an array of microphones such as a sound camera. A sound camera visualizes sound in color contours similar to the way a thermal camera visualizes temperature. A microphone array, which implements a beamforming method, locates noise sources visually, making it one of the best devices to detect buzz, squeak, and rattle (BSR) noises. This is a presentation and demonstration of a portable system developed with the cooperation of Hyundai Motors to visualize and identify annoying transient BSR noise sources in Hyundai automobiles. The solution involves developing a handheld sound camera with National Instruments LabVIEW system design software that identifies and displays noise sources in real time using microelectromechanical system (MEMS) and field-programmable gate array (FPGA) technologies to increase the image update rate and to decrease the total weight of the device.

Comparison of Models for a Piezoelectric 31-Mode Segmented Cylindrical Transducer

Friday, September 20, 2013 4:00 p.m. in ETC 4.150

Nicholas J. Joseph
Applied Research Laboratories and Department of Mechanical Engineering
The University of Texas at Austin
http://www.arlut.utexas.edu
http://www.me.utexas.edu

Piezoelectric transducers with thin-shelled cylindrical geometry are often used to radiate axisymmetric acoustic fields underwater. This is achieved by generating a uniform electric field across the thickness of the piezoelectric cylinder to develop circumferential strains and, consequently, uniform radial expansion. The uniform radial expansion is known as the breathing mode and is the desired behavior of these sources. To tune their performance in a cost-effective way, the cylinders can be constructed of alternating active (piezoelectric) and inactive (non-piezoelectric) segments along their circumference. Existing lumped parameter models for these transducers reduce the system to a single degree of freedom using effective piezoelectric properties of the composite cylinder. These models accurately capture the breathing motion of the cylinder but neglect other modes and overestimate the efficiency of the transducer. Experiments show that segmented transducers may demonstrate a detrimental higher frequency resonance within the operational frequency band. The parasitic mode associated with this resonance is shown to result from bending motion of the segments and can significantly decrease the radiated acoustic pressure. Discussed here is the development of a multiple-degree-of-freedom lumped parameter model that captures both the breathing and bending modes of the transducer and provides a more accurate estimate of its efficiency. Results from the multi-degree-of-freedom model are compared with those from a one-degree-of-freedom model, finite element models, and experimental data.

Product Sound Quality—The Music that Machines Make

Friday, September 27, 2013 4:00 p.m. in ETC 4.150

David A. Nelson, INCE Bd. Cert., PE
Principal Consultant, Nelson Acoustics
Elgin, Texas
http://www.nelsonacoustical.com

The experience of product noise depends not just on the sound pressure level, but on a host of perceptual factors including loudness, spectral balance, tonality, and modulation. Overlaid atop these are social factors such as cultural expectations, the context in which the sound is presented, potential for annoyance or distraction, threshold of hearing, and personal preference. The subjective and objective sides of acoustics are connected through proper selection of objective metrics, development of stimuli, structure of presentations, and statistical analysis methods. The result is an objective “recipe” for a product sound that is likely to be acceptable in the marketplace, which in turn forms the basis for noise control efforts. Data from actual product sound quality studies will be used where possible.

Sound Concentration, Enhanced Nonlinearities and Giant Nonreciprocal Response in Acoustic Metamaterials

Friday, October 4, 2013 4:00 p.m. in ETC 4.150

Professor Andrea Alù
Department of Electrical and Computer Engineering
The University of Texas at Austin
http://users.ece.utexas.edu/~aalu

In this talk, I will discuss our recent progress and research activity in the field of acoustic metamaterials, focused on the general objective of enhancing sound-matter interactions in artificial materials. I will show how suitably designed metamaterials may be used to concentrate acoustic energy in small channels, producing giant nonlinear response, enhanced absorption and anomalous impedance matching. I will also discuss our recent theoretical and experimental results aimed at inducing acoustic isolation and large nonreciprocal sound transmission using metamaterial concepts. We achieve these effects by producing the acoustic equivalent of the Zeeman effect in a subwavelength meta-molecule consisting of a resonant ring cavity loaded by a circulating fluid. This concept has been used to realize a compact, fully linear, magnetic-free diode for airborne acoustic waves, which achieves up to 40 dB isolation at audible frequencies in a subwavelength device. Physical insights into these phenomena will be discussed during the talk.

Refinements in the Resonator Sound Speed Technique and Sound Exposure in Motorsports Audiences

Friday, October 18, 2013 4:00 p.m. in ETC 4.150

Craig N. Dolder
Applied Research Laboratories and Department of Mechanical Engineering
The University of Texas at Austin
http://www.arlut.utexas.edu
http://www.me.utexas.edu

This seminar covers two independent topics. The resonator sound speed technique has been used by researchers at the University of Texas at Austin to determine the acoustic effective medium properties of freely rising bubbles in water, methane hydrates, seagrass, fluid-like gas-bearing sediment, and recently fish schools. Despite the robust nature of this method for non-dispersive materials, the interpretation of the acoustic field present in the resonators is not intuitive for dispersive media. However, when measured acoustic resonance frequencies can be correctly associated with the appropriate acoustic mode, interesting insight into highly dispersive systems can be gained. This presentation walks through recent improvements and insights regarding this technique. The second topic covers the initial analysis of calibrated sound recordings taken at a recent motorsports event. These recordings were analyzed in order to provide the noise dosage seen in three different spectator locations. The results show that spectators are exposed to more noise than is allowed by the OSHA standards for workplace safety.

An Overview of the Combustive Sound Source: History and Recent Developments

Friday, October 25, 2013 4:00 p.m. in ETC 4.150

Andrew R. McNeese
Applied Research Laboratories
The University of Texas at Austin
http://www.arlut.utexas.edu

This seminar describes the development and testing of the Combustive Sound Source (CSS), which is a broadband underwater sound source. The CSS is being developed as a clean, safe, and cost effective replacement for underwater explosive charges, which present an inherent danger to marine life and researchers using the charges. The basic operation of the CSS is as follows. A combustible mixture of gas is held below the surface of the water in a combustion chamber and ignited with an electric spark. A combustion wave propagates through the mixture and converts the fuel and oxidizer into a bubble of combustion products, which expands due to an increase in temperature, and then ultimately collapses to a volume that is smaller than before ignition, producing a high intensity, low frequency acoustic signal. The seminar begins by discussing the history and purpose of developing the CSS. It continues by describing the essential components of the device and convenient features added to recent mechanical designs. The general operation is discussed along with a description of various experiments conducted to determine the acoustic output and robustness of recent modifications to the CSS. Results from the experiments are presented to show that the CSS can be deployed from a stationary platform or a towed body throughout the water column, including at the water-sediment interface, to meet various experimental needs. Future work and plans are discussed to conclude the seminar.

How Language Experience Changes Our Speech Perception

Friday, November 1, 2013 4:00 p.m. in ETC 4.150

Professor Chang Liu
Department of Communication Sciences and Disorders
The University of Texas at Austin
http://csd.utexas.edu/faculty/chang-liu

It is well known that when listening in noise, English non-native listeners have more difficulty to perceive English speech sounds than English-native listeners. Previous work in our laboratory found that the identification of English phonemes, especially English vowels, was quite challenging in noise for non-native listeners. The native advantage became greater from quiet to noisy conditions, indicating more negative impacts of noise for non-native listeners than for native listeners. Moreover, given the same native language background, non-native listeners with more native English experience (e.g., Chinese-native listeners in the US) outperformed their peers with little or no native English experience (e.g., Chinese-native listeners in China) in English phonemic identification in multi-talker babble noise, while the two groups of non-native listeners had similar performance in quiet and long-term speech-shaped noise. We proposed two possible explanations: 1) native English exposure may help non-native listeners use the cue of the temporal fluctuation in noise more efficiently; 2) native English exposure may improve non-native listeners' capacity to reduce informational masking of multi-talker babble. Two present studies are being conducted to test the two hypotheses. The preliminary results showed that both possibilities may be present. These studies suggest that when learning English as a second language, listeners may benefit from native English exposures, active or passive, by using acoustic and/or phonetic cues in speech and noise more efficiently.

Sound Systems Design for Mass Audiences

Friday, November 8, 2013 4:00 p.m. in ETC 4.150

Craig Janssen
Managing Director
Acoustic Dimensions
Dallas, Texas
http://www.acousticdimensions.com/index.html

Acoustic Dimensions has been fortunate to serve as the acoustics and technology consultant for dozens of major sports venues and hundreds of large assembly event centers worldwide. The technology design at the Circuit of the Americas will be used as a case study to discuss the challenges of communicating both entertainment and emergency messaging to mass audiences. This will be compared briefly with various other stadia and enclosed venues. Issues of emergency evacuation complexities, and technology design to allow this, will also be addressed.

The Effect of Shape, Shell Thickness, and Fill Material on the Resonance Frequency, Quality Factor and Attenuation of Bubbles

Friday, November 15, 2013 4:00 p.m. in ETC 4.150

Kyle S. Spratt and Gregory R. Enenstein
Applied Research Laboratories and Mechanical Engineering Department
The University of Texas at Austin
http://www.arlut.utexas.edu
http://www.me.utexas.edu

The topics discussed are related to the acoustics of air bubbles in water, with applications in underwater noise abatement and the acoustics of fish schools. The first half of this seminar describes an investigation of the resonance frequency of an *arbitrarily shaped* ideal bubble using an analytical, lumped-element approach. The problem of finding the effective mass of the bubble is equivalent to a classical problem in electrostatics, as was first noted by M. Strasberg in 1953 [*J. Acoust. Soc. Am.* 25, 536–537]. The resonance frequency for various bubble geometries is presented, with special attention paid to the case of a toroidal bubble, and the results are compared with a finite-element numerical model of the corresponding full acoustic scattering problem. The second half of the seminar explores some details of encapsulated bubble acoustics (shell thickness and fill material) and also describes a simple laboratory measurement technique that is being developed to substitute for expensive open-water tests. Measurements made in a small (sub-wavelength) laboratory tank of the resonance frequencies and quality factors of single encapsulated bubbles with various shell thicknesses and fill materials are compared to measurements of the attenuation due to arrays of the same encapsulated bubbles measured in open water.