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ultrasonic industry association
UIA
powering sound ideas

Vibrations

Powering Sound Ideas

Virtual Collaborations - Third Edition

The third **Virtual Collaboration** will be held on Thursday, 4 March 2021 at 10 am EST / 3 pm GMT

Mark Hodnett, National Physical Laboratory, UK, and Dr. Andrew Mathieson, Thales UK, will present **Tools and techniques for characterizing transducers.** They will discuss various methods for characterising the output and performance of a power ultrasound transducer, and also of the components within it. Specific examples will help you decide when to use a particular measurement approach and will give insights into the sensitivities and inter-relations between system parts.

Registration is just $50 for UIA members.

"Please continue with broad appeal subject matter and great presenters ."

Register Now

Special Points of Interest

Small group discussions will give participants the opportunity to share ideas with their colleagues and peers about the information presented and specific applications.

UIA49 - A Virtual Symposium: 26 - 28 April 2021

The UIA Board of Directors is pleased to announce that the ultrasonic community WILL meet in 2021!

A modified 3-day program that offers medical sessions, workshops and industrial sessions, invited speakers, presentations, unconference opportunities in a shortened format will provide the opportunity for UIA members and nonmembers to learn about the newest advances in ultrasound and share information with their colleagues.

Exhibitors will be assigned time during the conference to present their latest information.

Want to present?

UIA has a new proposal submission site that is easier to use. We're looking for 15 minute presentations on topics you want to share with your global ultrasonic colleagues.

SUBMIT YOUR PROPOSAL

Register Now!

Full registration for members is just $199. Nonmembers can register for $299 and students for just $99.

REGISTER NOW!

See page 2 for more information.

More about UIA49 - Virtual Symposium

Robin Cleveland - Invited Speaker: Medical

Robin Cleveland is Professor of Engineering Science at the University of Oxford and Tutorial Fellow at Magdalen

College, Oxford. He received the PhD degree in Mechanical Engineering from the University of Texas at Austin where his doctoral research was on sonic boom propagation in the atmosphere. At the completion of his PhD he was awarded the F.V. Hunt Fellowship of the Acoustical Society of America at the University of Washington in Seattle studying shock wave lithotripsy – breaking of kidney stones by shock waves. After two years in Seattle he joined the faculty at Boston University for fourteen years rising to the rank of Professor of Mechanical Engineering. In 2011 he joined BUBL, in Oxford. Robin was a keynote speaker at 2010 UIA Symposium.

His research is in nonlinear acoustics with particular application to biomedical ultrasound. Areas of research include: shock wave lithotripsy, high intensity focused ultrasound surgery for thermal ablation, nonlinear distortion of B-mode diagnostic ultrasound, the development of shelled microbubble for ultrasound theranostics (targeted imaging and drug-delivery).

Mike Draper & Rob Perkins, - Invited Speakers: Industrial

Mike Draper, Managing Director and Rob Perkins, Director of Sonic Systems, Ltd., UK. Sonic Systems was founded in 1985 by John Perkins who spent all his working life in the field of power ultrasound originally working out of the Mullard Research Laboratories (Philips Group), with such notables as Ernie Nepparias. Sonic Systems grew on the reputation of providing high quality leading edge ultrasonic process systems dedicated principally in the OEM market. However, key customers gave

Rob Perkins

the company immediate credence within the market place and allowed Sonic Systems to grow a significant product base.

Sonic Systems was incorporated in 2000 and since this period has successfully expanded the customer base , and is at the leading edge of power ultrasound providing state of the art ultrasonically enabled technology worldwide.

Their presentation will cover some background to Sonic Systems' approach to developing advanced engineering solutions in power ultrasound, and then focus on specific examples where real-world applications are benefitting from the technology, at scale.

Registration Information

With the lower overhead of a virtual symposium, UIA is delighted to pass these savings on to our participants:

Registration Fees

Members: $199

Nonmembers: $299

Students: $99

Late Fee

There is a $30 late fee for member & nonmember registrations received **after 31 March.**

Exhibits/Sponsors: $1,500 and up

Daily Schedule

The symposium will begin each day (Monday, 26 April - Wednesday, 28 April) at 9 am ET / 2 pm GMT and conclude at 2 pm ET/ 7 pm GMT.

The Medical session on Monday and Industrial session on Wednesday will include an invited speaker, 15 minute presentations, two unconference opportunities to ask questions and chat with colleagues.

Tuesday will feature two workshops with break-out sessions, an unconference period and a virtual showcase of Warwick University.

Exhibitors

Exhibiting companies will have assigned break-out rooms for participants to visit with representatives to hear about their products and services.

Posters

UIA is using a virtual poster platform this year, which provides a dynamic, interactive review of research results.

Students are invited to submit their poster proposals by using this link *Submit Your Proposal.*

Ultrasound Applications in the News

Engineers combine light and sound to see underwater

Stanford University engineers have developed an airborne method for imaging underwater objects by combining light and sound to break through the seemingly impassable barrier at the interface of air and water.

The researchers envision their hybrid optical-acoustic system one day being used to conduct drone-based biological marine surveys from the air, carry out large-scale aerial searches of sunken ships and planes, and map the ocean depths with a similar speed and level of detail as Earth's landscapes. Their "Photoacoustic Airborne Sonar System" is detailed in a recent study published in the journal IEEE Access. "Airborne and spaceborne radar and laser-based, or LIDAR, systems have been able to map Earth's landscapes for decades. Radar signals are even able to penetrate cloud coverage and canopy coverage. However, seawater is much too absorptive for imaging into the water," said study leader Amin Arbabian, an associate professor of electrical engineering in Stanford's School of Engineering. "Our goal is to develop a more robust system which can image even through murky water."

Energy loss

Oceans cover about 70 percent of the Earth's surface, yet only a small fraction of their depths have been subjected to high-resolution imaging and mapping.

The main barrier has to do with physics: Sound waves, for example, cannot pass from air into water or vice versa without losing most -- more than 99.9 percent -- of their energy through reflection against the other medium. A system that tries to see underwater using soundwaves traveling from air into water and back into air is subjected to this energy loss twice -- resulting in a 99.9999 percent energy reduction.

Similarly, electromagnetic radiation -- an umbrella term that includes light, microwave and radar signals -- also loses energy when passing from one physical medium into another, although the mechanism is different than for sound. "Light also loses some energy from reflection, but the bulk of the energy loss is due to absorption by the water," explained study first author Aidan Fitzpatrick, a Stanford graduate student in electrical engineering. Incidentally, this absorption is also the reason why sunlight can't penetrate to the ocean depth and why your smartphone -- which relies on cellular signals, a form of electromagnetic radiation -- can't receive calls underwater.

> The researchers envision their hybrid optical-acoustic system one day being used to conduct drone-based biological marine surveys

The upshot of all of this is that oceans can't be mapped from the air and from space in the same way that the land can. To date, most underwater mapping has been achieved by attaching sonar systems to ships that trawl a given region of interest. But this technique is slow and costly, and inefficient for covering large areas.

An invisible jigsaw puzzle

Enter the Photoacoustic Airborne Sonar System (PASS), which combines light and sound to break through the air-water interface. The idea for it stemmed from another project that used microwaves to perform "non-contact" imaging and characterization of underground plant roots. Some of PASS's instruments were initially designed for that purpose in collaboration with the lab of Stanford electrical engineering professor Butrus Khuri-Yakub.

At its heart, PASS plays to the individual strengths of light and sound. "If we can use light in the air, where light travels well, and sound in the water, where sound travels well, we can get the best of both worlds," Fitzpatrick said.

To do this, the system first fires a laser from the air that gets absorbed at the water surface. When the laser is absorbed, it generates ultrasound waves that propagate down through the water column and reflect off underwater objects before racing back toward the surface.

The returning sound waves are still sapped of most of their energy when they breach the water surface, but by generating the sound waves underwater with lasers, the researchers can prevent the energy loss from happening twice.
"We have developed a system that is sensitive enough to compensate for a loss of this magnitude and still allow for signal detection and imaging," Arbabian said.

The reflected ultrasound waves are recorded by instruments called transducers. Software is then used

Continued on next page

Ultrasound Applications in the News, continued

to piece the acoustic signals back together like an invisible jigsaw puzzle and reconstruct a three-dimensional image of the submerged feature or object.

"Similar to how light refracts or 'bends' when it passes through water or any medium denser than air, ultrasound also refracts," Arbabian explained. "Our image reconstruction algorithms correct for this bending that occurs when the ultrasound waves pass from the water into the air."

Drone ocean surveys

Conventional sonar systems can penetrate to depths of hundreds to thousands of meters, and the researchers expect their system will eventually be able to reach similar depths.

To date, PASS has only been tested in the lab in a container the size of a large fish tank. "Current experiments use static water but we are currently working toward dealing with water waves," Fitzpatrick said. "This is a challenging but we think feasible problem."

The next step, the researchers say, will be to conduct tests in a larger setting and, eventually, an open-water environment.

"Our vision for this technology is on-board a helicopter or drone," Fitzpatrick said. "We expect the system to be able to fly at tens of meters above the water."

See video: https://youtu.be/2YyAnxQkeuk

SOURCE: Materials provided by Stanford School of Engineering .

Perfect transmission through barrier using sound

The perfect transmission of sound through a barrier is difficult to achieve, if not impossible based on our existing knowledge. This is also true with other energy forms such as light and heat.

A research team led by Professor Xiang Zhang, President of the University of Hong Kong (HKU) when he was a professor at the University of California, Berkeley, (UC Berkeley) has for the first time experimentally proved a century old quantum theory that relativistic particles can pass through a barrier with 100% transmission. The research findings have been published in the top academic journal Science.

Just as it would be difficult for us to jump over a thick high wall without enough energy accumulated. In contrast, it is predicted that a microscopic particle in the quantum world can pass through a barrier well beyond its energy regardless of the height or width of the barrier, as if it is "transparent."

As early as 1929, theoretical physicist Oscar Klein proposed that a relativistic particle can penetrate a potential barrier with 100% transmission upon normal incidence on the barrier. Scientists called this exotic and counterintuitive phenomenon the "Klein tunneling" theory. In the following 100 odd years, scientists tried various approaches to experimentally test Klein tunneling, but the attempts were unsuccessful and direct experimental evidence is still lacking.

Professor Zhang's team conducted the experiment in artificially designed phononic crystals with triangular lattice. The lattice's linear dispersion properties make it possible to mimic the relativistic Dirac quasiparticle by sound excitation, which led to the successful experimental observation of Klein tunneling.

> This achievement presents a new platform for exploring emerging macroscale systems

"This is an exciting discovery. Quantum physicists have always tried to observe Klein tunneling in elementary particle experiments, but it is a very difficult task. We designed a phononic crystal similar to graphene that can excite the relativistic quasiparticles, but unlike natural material of graphene, the geometry of the human-made phononic crystal can be adjusted freely to precisely achieve the ideal conditions that made it possible to the first direct observation of Klein tunneling," said Professor Zhang.

The achievement not only represents a breakthrough in fundamental physics, but also presents a new platform for exploring emerging macroscale systems to be used in applications such as on-chip logic devices for sound manipulation, acoustic signal processing, and sound energy harvesting.

"In current acoustic communications, the transmission loss of acoustic energy on the interface is unavoidable. If the transmittance on the interface can be increased to nearly

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Ultrasound Applications in the News, continued

100%, the efficiency of acoustic communications can be greatly improved, thus opening up cutting-edge applications. This is especially important when the surface or the interface play a role in hindering the accuracy acoustic detection such as underwater exploration. The experimental measurement is also conducive to the future development of studying quasiparticles with topological property in phononic crystals which might be difficult to perform in other systems," said Dr. Xue Jiang, a former member of Zhang's team and currently an Associate Researcher at the Department of Electronic Engineering at Fudan University.

Dr. Jiang pointed out that the research findings might also benefit the biomedical devices. It may help to improve the accuracy of ultrasound penetration through obstacles and reach designated targets such as tissues or organs, which could improve the ultrasound precision for better diagnosis and treatment.

On the basis of the current experiments, researchers can control the mass and dispersion of the quasiparticle by exciting the phononic crystals with different frequencies, thus achieving flexible experimental configuration and on/off control of Klein tunneling. This approach can be extended to other artificial structure for the study of optics and thermotics. It allows the unprecedent control of quasiparticle or wavefront, and contributes to the exploration on other complex quantum physical phenomena.

Materials provided by The University of Hong Kong

Ultrasonic Parametric Speakers

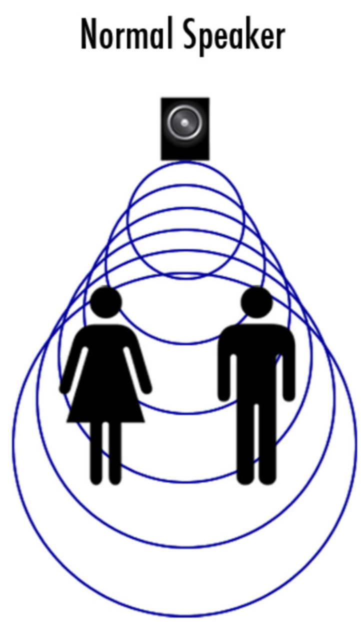
What is a parametric speaker?

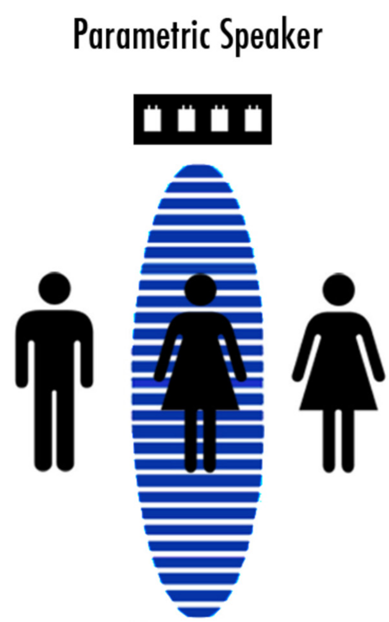
Experiments with parametric and directional speaker systems have been going on since the early 1960s. Ultrasonic sound has much smaller wavelengths than regular audible sound making it much more directional than a traditional loudspeaker system.

Most speakers are designed to throw sound as far and loud as possible. Parametric speakers are more like a laser beam with the sound focused at high intensity into a relatively small area. The result is that two people can be standing only a few feet apart from each other yet only one of them will hear the directional audio waves emanating from the parametric audio source.

Parametric Speakers Have Many Uses

The affects of parametric speakers are not only a great demonstration of how sound propagates through air but also offer many useful applications. Some of the possible uses for this amazing technology are:





Public Safety

In areas with large groups of people such as subways, airports and other public places, it may be beneficial to have a message playing at escalator landings, door entrances and other places where only the people in that small area need to hear the announcement.

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Ultrasound Applications in the News, continued

Commercial Advertising

Parametric speakers like the Soundlazer have already been used in commercial advertising. A person standing under a billboard to large video screen is the only one able to hear a recorded message. The advantages to this are twofold. The ultrasonic waves, being focused will get the attention of the listener and the repeated message will not be heard by others. Patrons and store clerks that would normally be distracted by the same message repeating over and over on a daily basis will no longer be annoyed by advertising that uses parametric technology.

Security / Alarm Systems

Parametric speakers combined with high decibel sirens have been used to deter robberies and other criminal activities.

Public Speaking

There are rumors surfacing on the web that some political candidates have used parametric arrays to beam live information directly into the ears of public speakers so that no earpiece or TelePrompTer is needed. While this hasn't been confirmed, it does offer interesting possibilities.

Parametric speakers are not new. This technology has been around since the 60's, however, it hasn't seen many advancements since its creation. Essentially, the device uses ultrasonic waves to carry

Parametric speakers are not new. This technology has been around since the 60's, however, it hasn't seen many advancements since its creation. Essentially, the device uses ultrasonic waves to carry sound to an individual or object. Compared to regular sound waves, ultrasonic waves are very concentrated and directional. This results in being able to "beam" sound in a specific direction. This is in direct contrast to regular sound waves which spread and disperse resulting in sound moving and bouncing in all directions.

sound to an individual or object. Compared to regular sound waves, ultrasonic waves are very concentrated and directional. This results in being able to "beam" sound in a specific direction. This is in direct contrast to regular sound waves which spread and disperse resulting in sound moving and bouncing in all directions.

The potential uses for this device are endless. In his short descriptive video, he mentions you are only limited by your imagination. Some of the outlined uses of the device per the [Soundlazer Snap Kickstarter page] are as follows:

- Fun with friends: The Soundlazer is simply a cool gadget to play with.
- Ambient Background Sound: Put the Soundlazer behind a plant or table in a room and "beam" background sounds or music into the room. Unlike other speakers, the Soundlazer will create virtual sound sources around the room.
- Showroom Floors: Beam important product information, advertisements or promotions quietly and discreetly to individual customers in your store.
- Animatronics and Displays: By pointing the Soundlazer at a stuffed animal, animated display or other object, the sound will appear come directly from the object the Soundlazer is pointed at.
- Public Safety: Warning selected people in a group of localized dangers or obstructions.
- Advertising: Selective billboards where only the person in front of a particular ad can hear the message.
- Security and Alarms: Clear and precise messages regarding break-ins, fires and other emergencies.
-

And there are many more uses!

For more information
https://www.soundlazer.com/what-is-a-parametric-speaker/#lightbox/0/

https://www.techsmash.net/beam-your-sound-with-the-soundlazer-snap/

From the President

Dominick DeAngelis

UIA President

Planning by UIA49 conference chair, and two time past-president Mark Hodnett is now well underway for our first "virtual-only" symposium in April, but we are still trying to keep the "learning" momentum going through our very popular Virtual Collaboration series, which is resuming again in March; our next topic by popular demand is "Tools and techniques for characterizing transducers," presented by our board member extraordinaires Mark Hodnett and Andrew Mathieson, so you know there will be lots of good stuff that you have never seen before from these guys! Depending on the success of our virtual UIA49 symposium theme, we may make this a regular part of our annual in-person symposium in the future as a hybrid, so please show your support with registration and attendance! And yes, rest assured we are planning for an in-person UIA50 event in 2022 at Warwick University, but we still hope to capture the "flavor" of Warwick this year for the virtual event by giving preference to the same presenters from 2020. This will also give them the opportunity to give us a nice update on their research in 2022 (no pressure). 🙂

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How can ultrasonics enhance the value of your business?

UIA is the international business forum for users, manufacturers, and researchers of ultrasonics. Our members use acoustic vibrations to improve materials, industrial processes, and medical technology. We call this *powering sound ideas.*

Let's work together to power your sound ideas. Contact a member consultant or company through our online Referral Network, learn about ultrasonics with our online primer, or meet industry leaders at our next symposium.

Important Dates

4 March 2021: Virtual Collaborations: Multi-Wavelength Probes and Blades: Tuning / Gain / Balancing

26 - 28 April 2021: Virtual UIA49 Symposium