Volume 30 Issue 2: 2021 Summer 2021

Vibrations

Powering Sound Ideas

Virtual Collaborations - September & more!

The fourth UIA **Virtual Collaboration** will be held on Thursday, 23 September 2021 at 10 am EST / 3 pm GMT

Kevin Houser, PE, Director, IP Strategy, Engineering Fellow, Intellectual Property Center of Excellence, Johnson & Johnson, Ethicon Endo-Surgery will present **Ultrasound in Surgical Devices: Advances in Robotic Surgery & HIFU applications.** This will be a continuation of this years series of presentations and where the first three were focused on technologies and measurements, the fourth will discuss applications with Kevin Houser presenting on aspect of ultrasound in surgical devices. Kevin has worked on ultrasonic cutting and coagulating devices used in surgery for over 20 years. He will provide information on how ultrasound is used to create beneficial tissue effects as well as going into some of the devices and algorithms that are making

Continued on page 5

Group Registrations are available

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 - Virtual Symposium Recap

By Mark Hodnett

The effects of the COVID pandemic are being felt across the globe, and the necessary restrictions on large groups of people meeting together have had a profound impact on the way in which scientific conferences are put together. Following the cancellation of our intended face-to-face 2020 Symposium in Warwick, UIA were determined to bounce back in 2021, and so we set about re-imagining the way in which we get together, creating an online experience to provide the collaborative, networking-rich environment that you've told us you value greatly. We developed our approaches through three successful Virtual Collaborations, and from this, UIA49 was thus designed to be our first fully-virtual Symposium. It was thrilling to see over 60 delegates joining our sessions.

Industrial Sessions

UIA President Dominick DeAngelis welcomed delegates to the Zoom session, remarking on the challenges and opportunities presented by the last 15 months, and he then introduced Symposium Chair Mark Hodnett. In

Continued on next page

More about UIA49 - Virtual Symposium

keeping with our usual themes, the Symposium kicked off with sessions on Industrial applications of ultrasonics.

Our **Day 1** keynote speakers were Mike Draper and Rob Perkins from Sonic Systems, UK, who gave a

Rob Perkins

fascinating overview of the design approaches, examples, methods, acquired wisdom and experience for building multi-transducer flow systems, enabling at-scale applications of High Power Ultrasonics.

Henrique Alves from ATCP Physical Engineering was our next speaker, and he described the development and testing of an instrument for determining prestress in piezoceramics, for studying preloading of bolt-clamped Langevin-type transducers, employing a charge flow integral. The new approach is able to determine electrical charge with an accuracy of around 1%.

Husain Shekhani, founder of Ultrasonic Advisors, LLC., then described a systematic approach for carrying out root cause analysis of ultrasonic transducers, reviewing in detail the typical failure modes, and outlining his approach, based around a DMAIC process.

The first of our renowned Unconference sessions then followed: each speaker hosted their own Zoom Breakout room, and delegates were free to move between virtual spaces, and pose their questions directly to the presenters. Stimulating discussions ensued, with the small number of rooms encouraging collaboration and additional problem-solving.

Lukman Yusuf from University of Glasgow was online next, discussing his PhD research into characterising cavitation activity from a 20 kHz Branson sonicator. Using acoustic emission and high speed photography, he investigated in detail the specific excitation regimes in which cavitation cluster collapse occurred, relating peaks to integer divisors of the fundamental frequency.

Pivoting the discussions towards Ultrasonic Additive Manufacturing, Amin Moghaddas from EWI presented his work on assessing process performance by using response surface methodology – this looks at the effects of parameters on device responses, and enables modelling, experimental design and system optimisation.

A second Unconference session followed, with delegates also opting for coffee/tea/lunch breaks depending on where in the world they were joining us from.

UIA is very grateful to all of its supporters, and Gold Sponsors Dukane were represented by Leo Klinstein (VP Engineering and R&D), who discussed their latest developments. Of particular interest were new ultrasonic welding technologies for the liquid food and fabric markets, for multi-layer sealing.

DUKANE

UIA President Dominick DeAngelis then described his team's work in optimizing joint interface flatness, particularly important to provide consistent performance in the wire bonding applications which are Kulicke and Soffa's speciality. White light interferometry was used to examine commercial transducer samples, showing typical issues such as coning (attributable to poling), and raised peripheral edges, of several microns in size, requiring secondary processing before assembly.

Our concluding presentation of the Industrial session was given by Jacqueline Mifsud, who is a PhD student at our virtual hosts, University of Warwick. Her work examines the interactions of bubbles with surfaces, which is prevalent throughout high power ultrasonic applications: she is looking in particular in confined spaces, applying a modified Rayleigh-Plesset approach to verify a numerical model created in OpenFOAM, and has demonstrated different classifications of collapse, depending on the bubble-boundary separation, and the proximity of a secondary opposing surface.

Continued on next page

More about UIA49 - Virtual Symposium

Day Two Workshops/Tour/Posters

In keeping with our traditional Symposium structure, our middle day was a lighter touch schedule. The first speaker was Rasmus Lou-Møller, Director of Engineering and Business Development at Meggitt A/S. He gave a very valuable update and insight into the ongoing challenge of the ROHS directive in the European Union, which includes restrictions and timelines on the sale and lifecycle management of lead and lead-containing products (into which PZT falls). The topic prompted significant discussion and debate, and we will learn soon from the EU whether the manufacturers' challenge to the scheduled July 2021 conclusion of the current exemption for PZT is upheld or rejected.

Our second speaker was Aoife Ivory, from the National Physical Laboratory, UK. Her research topic is photoacoustics, and specifically, the work she is doing to support the generation of measurement standards and phantoms. This will then build confidence and accelerate clinical adoption of this exciting new imaging modality.

Our poster session followed, featuring as highlights the research work from the Universities of Warwick, Glasgow and Monash. Poster presenters made excellent use of our online platform, supplementing their summarised content with additional videos and results, equipping them to tell a broader story of their scientific findings. Each hosted their own Zoom breakout room, and Symposium delegates moved freely between them to find out more.

The final presentation of Day 2 was a Virtual Tour of the ultrasound laboratories at the University of Warwick. It was crafted, authored and presented by Professor Steve Dixon, and was superbly produced, showcasing his group's projects and facilities for non-destructive analysis and testing, interferometry, flow and field characterisation, fabrication and computational modelling. It was the perfect trailer and primer for what we hope will be in-person tours of the laboratories in 2022.

> "It was much better than I thought it would be. While not the same as in person, much of the familiarity and collegiality was there"
>
> -UIA49 participant

Day Three - Medical Sessions

Our third day focused on medical applications of high power ultrasonics. It was a privilege to welcome **Professor Robin Cleveland** from the University of Oxford as our Keynote Speaker, and, building from the introductory story he presented at 2019's UIA Sound Solutions in Glasgow, he gave us a detailed, fascinating insight into his collaborative work on shock wave induced drug delivery. The presentation was a clear demonstration of how physics, biology, chemistry and engineering research and expertise coalesce to provide deep insight into how future therapies may be carried out.

Professor Robin Cleveland

Our next speaker was Jack Stevenson, from the University of Glasgow. He described his PhD research into ultrasound surgery, outlining the modelling steps and engineering approaches to develop a virtual prototype of a miniaturised focused transducer. Demonstrating the strong parallels between optics and acoustics, Jack's design employs a 3D-printed acoustic Fresnel lens to achieve the required focal performance.

Xuan Li, from the University of Glasgow took to the virtual podium next, presenting his work on therapeutic transducer design, in which he is looking at incorporating direct metal laser-sintered titanium-based components into ultrasonic surgical devices, with a folded, miniaturised design. In comparison to milled/annealed components, the laser-sintered approach currently demands more post-machining to improve performance, and is more prone to failure: designs are continuing to evolve.

Continued on next page

More about UIA49 - Virtual Symposium

Breakout rooms were then set up for each of the presenters for discussion, with delegates asking questions, and sharing their own experiences of similar topics

Nicola Fenu, University of Glasgow, then spoke about his work on characterising a range of piezoceramic and piezocrystal transducers at high drive levels, with an ultimate goal of surgical device miniaturisation. This is of particular interest: it builds on the base-level data provided by many commercial instruments for parameters such as impedance which typically operate at low voltage drives, and extends this to application-relevant levels.

Our final presentation from the excellent work ongoing at the University of Glasgow was from Andrew Feeney, who gave us a brief return to industrial applications. In collaboration with the Universities of Warwick and Portsmouth, he examined the design principles and modelled oil-filled flexural transducers in elevated pressure conditions, with manufactured prototypes now set for pitch-catch studies in environments up to 200 bar.

UIA is privileged and proud to have two of the leading ultrasonic surgery device manufacturers as sponsors, and the next two presentations showcased their technologies. First, Titanium sponsors Integra LifeSciences were represented by Director of Advanced Product Development, Dan Cotter, and Principal Ultrasonics Engineer, Jay Sheehan, both UIA Board Members. They reviewed Integra's recent developments, including a refresh to the Clarity product line, bringing it into line with CUSA Excel. Dan remarked that each evolution has to gain surgeons' approval, in terms of effectiveness and ease of use. A particular focus is on providing tissue selectivity, and Dan described how cavitation plays an important role in this.

Next, Bronze Sponsors Misonix, who were represented by Vice President of Engineering and R&D, Dan Voic, also a UIA Board Member. Dan described some of the history of the company, and their commitment to harness disruptive and innovative solutions to provide patient benefits. Misonix identify a broad range of interventions, from bone sculpting, through surgical aspiration, to wound debridement, all of which are achieved by their Nexus platform technology. In the latter application, they pay particular attention to the benefits of ultrasound in removing necrotic tissue and associated biofilms, maximising the retention of healthy tissue.

For the concluding presentation of the conference, reflecting the truly international reach of UIA, we were joined by Martin Szarksi from the University of Monash, Melbourne, Australia. His work is in improving the segmentation of Intravascular Ultrasound (IVUS) images – IVUS is an important and valuable technology, providing images of plaque build-up in coronary arteries, which is a major factor in cardiovascular disease. Called IVUS-Net, the developed tool harnesses machine learning methods, and extracts rapidly the inner and outer vessel walls from B-mode images, significantly improving vascular images.

In closing UIA49, Symposium Chair Mark Hodnett and UIA President Dominick De Angelis both thanked the delegates for creating a genuinely collaborative and interactive environment, which enriched the quality of the proffered presentations during stimulating discussions, and conveyed their aspirations that we will all be able to resume face-to-face conferencing during 2022.

UIA49 – what you told us

Around half of our delegates responded to the post-Symposium survey, which is very useful: it provides the opportunity for UIA to check that we are meeting and exceeding your expectations.

Selected comments:

"The wide-ranging expertise of the presenters and organizers exposed me to a wealth of topics related to ultrasonics and helped me to see beyond the narrow range of my own experience in the field. I enjoyed the equal mixture of academic and industrial applications. Many of the underlying challenges of ultrasonics are the same across the field but the approaches to address them vary. Seeing these different approaches and perspectives will be beneficial to me in the future. I plan to become a member and attend future symposia"

"Great application of technology to bring us together. I would not have attended had it been in-person only"

Virtual Collaborations,

ultrasound the mechanism of choice for many surgeons. In addition he will touch on some advances in these devices for robotic surgery and on HIFU applications of ultrasound.

Looking ahead…

This year's Virtual Collaborations have been very well received and as a result we are turning them into a regular feature of the UIA.

Look forward to invites for four separate sessions during the course of the year in February, June, September and November. We have selected this schedule so that we can bring you great content on a regular basis but not interfere with our annual conference or summer breaks! And we will be adding a new wrinkle to these presentations, a mini-symposium! The presentations in February, June and November will continue with our 1 hour format and a topic of discussion, but our September session will be an expanded 2 hour mini Symposium with a series of presentations on a specific area of ultrasonic technology, ranging from ceramics, transducers, control systems waveguides and other technologies. And don't forget our main Symposium in April!

We look forward to seeing you at these presentations during the course of 2022!

Ultrasound Applications in the News

Reading minds with ultrasound: A less-invasive technique to decode the brain's intentions

What is happening in your brain as you are scrolling through this page? In other words, which areas of your brain are active, which neurons are talking to which others, and what signals are they sending to your muscles?

Mapping neural activity to corresponding behaviors is a major goal for neuroscientists developing brain-machine interfaces (BMIs): devices that read and interpret brain activity and transmit instructions to a computer or machine. Existing BMIs can, for example, connect a paralyzed person with a robotic arm; the device interprets the person's neural activity and intentions and moves the robotic arm correspondingly.

A major limitation for the development of BMIs is that the devices require invasive brain surgery to read out neural activity. But now, a collaboration at Caltech has developed a new type of minimally invasive BMI to read out brain activity corresponding to the planning of movement. Using functional ultrasound (fUS) technology, it can accurately map brain activity from precise regions deep within the brain at a resolution of 100 micrometers (the size of a single neuron is approximately 10 micrometers).

The new fUS technology is a major step in creating less invasive, yet still highly capable, BMIs.

"Invasive forms of brain-machine interfaces can already give movement back to those who have lost it due to neurological injury or disease," says Sumner Norman, postdoctoral fellow in the Andersen lab and co-first author on the new study. "Unfortunately, only a select few with the most severe paralysis are eligible and willing to have electrodes implanted into their brain. Functional ultrasound is an incredibly exciting new method to record detailed brain activity without damaging brain tissue. We pushed the limits of ultrasound neuroimaging and were thrilled that it could predict movement. What's most exciting is that fUS is a young technique with huge potential -- this is just our first step in bringing high performance, less invasive BMI to more people."

> A collaboration at Caltech has developed a new type of minimally invasive BMI to read out brain activity corresponding to the planning of movement.

The new study is a collaboration between the laboratories of Richard Andersen, James G. Boswell Professor of Neuroscience and Leadership Chair and director of the Tianqiao and Chrissy Chen Brain-Machine Interface Center in the Tianqiao and Chrissy Chen Institute for Neuroscience at Caltech; and of Mikhail Shapiro, professor of chemical engineering and Heritage Medical Research Institute Investigator. Shapiro

Continued on next page

Ultrasound Applications in the News

is an affiliated faculty member with the Chen Institute.

A paper describing the work appears in the journal Neuron on March 22.

In general, all tools for measuring brain activity have drawbacks. Implanted electrodes (electrophysiology) can very precisely measure activity on the level of single neurons, but, of course, require the implantation of those electrodes into the brain. Non-invasive techniques like functional magnetic resonance imaging (fMRI) can image the entire brain but require bulky and expensive machinery. Electroencephalography (EEGs) does not require surgery but can only measure activity at low spatial resolution.

Ultrasound works by emitting pulses of high frequency sound and measuring how those sound vibrations echo throughout a substance, such as various tissues of the human body. Sound travels at different speeds through these tissue types and reflects at the boundaries between them. This technique is commonly used to take images of a fetus in utero, and for other diagnostic imaging.

Ultrasound can also "hear" the internal motion of organs. For example, red blood cells, like a passing ambulance, will increase in pitch as they approach the source of the ultrasound waves, and decrease as they flow away. Measuring this phenomenon allowed the researchers to record tiny changes in the brain's blood flow down to 100 micrometers (on the scale of the width of a human hair).

"When a part of the brain becomes more active, there's an increase in blood flow to the area. A key question in this work was: If we have a technique like functional ultrasound that gives us high-resolution images of the brain's blood flow dynamics in space and over time, is there enough information from that imaging to decode something useful about behavior?" Shapiro says. "The answer is yes. This technique produced detailed images of the dynamics of neural signals in our target region that could not be seen with other non-invasive techniques like fMRI. We produced a level of detail approaching electrophysiology, but with a far less invasive procedure."

The collaboration began when Shapiro invited Mickael Tanter, a pioneer in functional ultrasound and director of Physics for Medicine Paris (ESPCI Paris Sciences et Lettres University, Inserm, CNRS), to give a seminar at Caltech in 2015. Vasileios Christopoulos, a former Andersen lab postdoctoral scholar (now an assistant professor at UC Riverside), attended the talk and proposed a collaboration. Shapiro, Andersen, and Tanter then received an NIH BRAIN Initiative grant to pursue the research. The work at Caltech was led by Norman, former Shapiro lab postdoctoral fellow David Maresca (now assistant professor at Delft University of Technology), and Christopoulos. Along with Norman, Maresca and Christopoulos are co-first authors on the new study.

The technology was developed with the aid of non-human primates, who were taught to do simple tasks that involved moving their eyes or arms in certain directions when presented with certain cues. As the primates completed the tasks, the fUS measured brain activity in the posterior parietal cortex (PPC), a region of the brain involved in planning movement. The Andersen lab has studied the PPC for decades and has previously created maps of brain activity in the region using electrophysiology. To validate the accuracy of fUS, the researchers compared brain imaging activity from fUS to previously obtained detailed electrophysiology data.

Next, through the support of the T&C Chen Brain-Machine Interface Center at Caltech, the team aimed to see if the activity-dependent changes in the fUS images could be used to decode the intentions of the non-human primate, even before it initiated a movement. The ultrasound imaging data and the corresponding tasks were then processed by a machine-learning algorithm, which learned what patterns of brain activity correlated with which tasks. Once the algorithm was trained, it was presented with ultrasound data collected in real time from the non-human primates.
The algorithm predicted, within a few seconds, what behavior the non-human primate was going to carry out (eye movement or reach), direction of the movement (left or right), and when they planned to make the movement.

Continued on next page

Ultrasound Applications in the News, continued

"The first milestone was to show that ultrasound could capture brain signals related to the thought of planning a physical movement," says Maresca, who has expertise in ultrasound imaging. "Functional ultrasound imaging manages to record these signals with 10 times more sensitivity and better resolution than functional MRI. This finding is at the core of the success of brain-machine interfacing based on functional ultrasound."

"Current high-resolution brain-machine interfaces use electrode arrays that require brain surgery, which includes opening the dura, the strong fibrous membrane between the skull and the brain, and implanting the electrodes directly into the brain. But ultrasound signals can pass through the dura and brain non-invasively. Only a small, ultrasound-transparent window needs to be implanted in the skull; this surgery is significantly less invasive than that required for implanting electrodes," says Andersen.

Though this research was carried out in non-human primates, a collaboration is in the works with Dr. Charles Liu, a neurosurgeon at USC, to study the technology with human volunteers who, because of traumatic brain injuries, have had a piece of skull removed. Because ultrasound waves can pass unaffected through these "acoustic windows," it will be possible to study how well functional ultrasound can measure and decode brain activity in these individuals.

SOURCE: Materials provided by California Institute of Technology. Original written by Lori Dajose

Life's rich pattern: Researchers use sound to shape the future of printing

Researchers in the UK have developed a way to coax microscopic particles and droplets into precise patterns by harnessing the power of sound in air. The implications for printing, especially in the fields of medicine and electronics, are far-reaching.

The scientists from the Universities of Bath and Bristol have shown that it's possible to create precise, pre-determined patterns on surfaces from aerosol droplets or particles, using computer-controlled ultrasound. A paper describing the entirely new technique, called 'sonolithography', is published in Advanced Materials Technologies.

Professor Mike Fraser from the Department of Computer Science at the University of Bath, explained: "The power of ultrasound has already been shown to levitate small particles. We are excited to have hugely expanded the range of applications by patterning dense clouds of material in air at scale and being able to algorithmically control how the material settles into shapes."

The researchers believe their work could revolutionise printing, improving the speed, cost, and precision of non-contact patterning techniques in air. Their work already shows the potential of sonolithography for biofabrication.

Dr Jenna Shapiro, research associate in the School of Cellular and Molecular Medicine at the University of Bristol and lead author of the article, said: "Sonolithography enables gentle, non-contact and rapid patterning of cells and biomaterials on surfaces. Tissue engineering can use biofabrication methods to build defined structures of cells and materials. We are adding a new technique to the biofabrication toolbox."

> It's possible to create precise, pre-determined patterns on surfaces from aerosol droplets or particles

Professor Bruce Drinkwater, professor of Ultrasonics in Bristol's Department of Mechanical Engineering, added: "The objects we are manipulating are the size of water drops in clouds. It's incredibly exciting to be able to move such small things with such fine control. This could allow us to direct aerosol sprays with unheard of precision, with applications such as drug delivery or wound healing."

Beyond its applications in biomedicine, the team has shown the technique to be applicable to a variety of materials. Printed electronics is another area the team is keen to develop, with sonolithography being used to arrange conductive inks into circuits and components.

Materials provided by University of Bath

Ultrasound Applications in the News, continued

Tiny, wireless, injectable chips use ultrasound to monitor body processes

Widely used to monitor and map biological signals, to support and enhance physiological functions, and to treat diseases, implantable medical devices are transforming healthcare and improving the quality of life for millions of people. Researchers are increasingly interested in designing wireless, miniaturized implantable medical devices for in vivo and in situ physiological monitoring. These devices could be used to monitor physiological conditions, such as temperature, blood pressure, glucose, and respiration for both diagnostic and therapeutic procedures.

To date, conventional implanted electronics have been highly volume-inefficient -- they generally require multiple chips, packaging, wires, and external transducers, and batteries are often needed for energy storage. A constant trend in electronics has been tighter integration of electronic components, often moving more and more functions onto the integrated circuit itself.

Researchers at Columbia Engineering report that they have built what they say is the world's smallest single-chip system, consuming a total volume of less than 0.1 mm3. The system is as small as a dust mite and visible only under a microscope. In order to achieve this, the team used ultrasound to both power and communicate with the device wirelessly. The study was published online May 7 in Science Advances.

"We wanted to see how far we could push the limits on how small a functioning chip we could make," said the study's leader Ken Shepard, Lau Family professor of electrical engineering and professor of biomedical engineering. "This is a new idea of 'chip as system' -- this is a chip that alone, with nothing else, is a complete functioning electronic system. This should be revolutionary for developing wireless, miniaturized implantable medical devices that can sense different things, be used in clinical applications, and eventually approved for human use."

The team also included Elisa Konofagou, Robert and Margaret Hariri Professor of Biomedical engineering and professor of radiology, as well as Stephen A. Lee, PhD student in the Konofagou lab who assisted in the animal studies.

Elisa Konofagou spoke at the UIA48 Symposium in Orlando, Florida, in 2013

The design was done by doctoral student Chen Shi, who is the first author of the study. Shi's design is unique in its volumetric efficiency, the amount of function that is contained in a given amount of volume. Traditional RF communications links are not possible for a device this small because the wavelength of the electromagnetic wave is too large relative to the size of the device. Because the wavelengths for ultrasound are much smaller at a given frequency because the speed of sound is so much less than the speed of light, the team used ultrasound to both power and communicate with the device wirelessly. They fabricated the "antenna" for communicating and powering with ultrasound directly on top of the chip.

The chip, which is the entire implantable/injectable mote with no additional packaging, was fabricated at the Taiwan Semiconductor Manufacturing Company with additional process modifications performed in the Columbia Nano Initiative cleanroom and the City University of New York Advanced Science Research Center (ASRC) Nanofabrication Facility.

Shepard commented, "This is a nice example of 'more than Moore' technology -- we introduced new materials onto standard complementary metal-oxide-semiconductor to provide new function. In this case, we added piezoelectric materials directly onto the integrated circuit to transducer acoustic energy to electrical energy."

Konofagou added, "Ultrasound is continuing to grow in clinical importance as new tools and techniques become available. This work continues this trend."

The team's goal is to develop chips that can be injected into the body with a hypodermic needle and then communicate back out of the body using ultrasound, providing information about something they measure locally. The current devices measure body temperature, but there are many more possibilities the team is working on.

Materials provided by **Columbia University School of Engineering and Applied Science**. Original written by Holly Evarts.

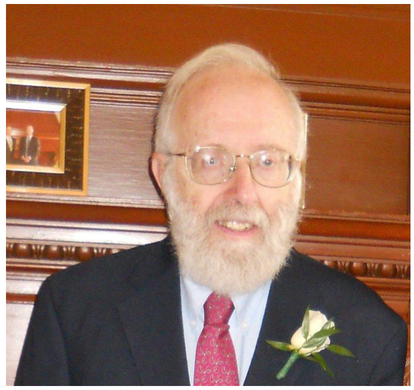
UIA Celebrates Sam Berliner, III

The Ultrasonic Industry Association celebrates the life of Sam Berliner, III. Sam was an honorary member, awarded in recognition of his many years of service to the ultrasonic industry and to the UIA organization. Sam helped to advance the field of ultrasonics, to promote the UIA, and to amaze us all with his enthusiasm for so many other projects.

An early member of the Ultrasonic Manufacturers Association (later renamed Ultrasonic Industry Association), Sam first attended the UMA's Annual Technical Symposium at JFK on his birthday on February 15, 1968 (a confirmed pack rat, he still has all the paperwork). He was the first editor of VIBRATIONS, the newsletter of the successor Ultrasonic Industry Association, producing it for many years, and was a long-time member of the UIA's Board of Directors and the first Chair of the Website Committee, hosting the original site.

S. (Sam) Berliner, III, was born in Manhattan, New York City, and lived on Long Island, New York, most of his life. He received his training in mechanical engineering at MIT and RPI and the degree of Bachelor of Science in Science from Adelphi College (now University).

He worked first for several years as a certified Ordnance Proof Director, testing tanks and self-propelled artillery for the U. S. Army at Aberdeen Proving Ground in Maryland. Sam then joined Pall Corporation, a leading manufacturer of ultra-fine fluid filters, becoming Manager of Support Services. He worked on the development of a probe-type ultrasonic fluid filter element cleaner, and was later responsible for upgraded models.



February 15th, 1934 – December 29th, 2020

He left Pall after 15 years to promote a line of miniature ultrasonic probes, then used primarily as biological cell disruptors and in ultrasonic soldering irons, and later served as applications engineer for dielectric oil pumping stations.

Sam then joined Heat Systems-Ultrasonics, Inc. (now Misonix Incorporated), where he was instrumental in bringing out a new line of ultrasonic cell disruptors, developing it into the leading ultrasonic liquid processing equipment (now made by Qsonica). As Director of Technical Services, Sam lectured widely and developed unique accessories and procedures, including the modern cup horn, sapphire tips, a patented continuous flow cell, and a novel means of determining surface cleanliness using ultrasonic ablation. He wrote many monographs (application notes and technical notes and bulletins) about this field, still in use, and two major articles on ultrasonic liquid processing, still widely distributed as reprints.

Sam has worked closely with the Environmental Protection Agency and ASTM, specifying or rewriting test methods utilizing ultrasonic probes to improve procedures.

In January of 1990, Sam began an ongoing independent consultancy in ultrasonic processing with the intent of forwarding the practical application of high-frequency sound to change materials. He kept active in his other forté, technical support, both of customers, representatives, and distributors, and of R&D and engineering staff; thus freeing the latter from what (to them) are arduous chores.

> *I knew and loved Sam's contributions through membership in the Ultrasonic Industry Association. He was fascinated by history especially the history of technology and had many fascinating stories to tell. A gentleman and a scholar, a unique soul.*
>
> Janet Devine

Sam continued to be active in ultrafine filtration, writing technical manuals on filtration and consulting on the application of ultrasonics to filtration, both for cleaning of filters and to improve filtration efficiency. He was a consulting technical writer and publisher in mechanical, electro-mechanical, and fluid systems for many years. In addition, he was contracted to write a book on high-intensity ultrasonics, take oral histories, and write and lecture about history, especially the history of technology as it applies to ultrasonics and transportation. Sam was instrumental in saving the remnant 1908 Long Island Motor Parkway, (a world's first)and now a bicycle/walk trail. He was the leading expert on the first production diesel locomotives. Sam lives on in his massive website, http://sbiii.com covering all these many areas and more.

This celebration was originally written by Ron Manna and Janet Devine on the occasion of the UIA Board of Directors conferring Honorary Membership to Sam in 2011.

From the President

Dominick DeAngelis

UIA President

Our first "virtual-only" UIA symposium was held in April, and by all accounts was a huge success! Although nothing could possibly capture the true "flavor" of our famously colloquial in-person events, which are always brimming with random conversations of diverse ultrasonic ideas during our "unconference sessions" and social gatherings, surprising to us all this "virtual" event came pretty close! With the nicely organized break-out rooms, along with the Zoom video of our attendees, and of course great content, this "virtual" event really had the "look and feel" of an in-person event (minus the alcohol); 🙂 this is a testament to the leadership our UIA49 "virtual" conference chair, and two time past-president Mark Hodnett. Also, as promised, with enthusiastic support and feedback from attendees and presenters, we are now looking at making the "virtual" part a regular feature of our annual in-person symposium in the future as a hybrid. The planning for an in-person UIA50 "hybrid" event in 2022 at Warrick University is now underway, and also stay tuned for our upcoming virtual collaborations this fall to keep the "learning" going all year long.

UIA Board

Ultrasonic Industry Association
11 W Monument Ave, Ste 510
Dayton OH USA

Phone: +1.937.586.3725
uia@ultrasonics.org

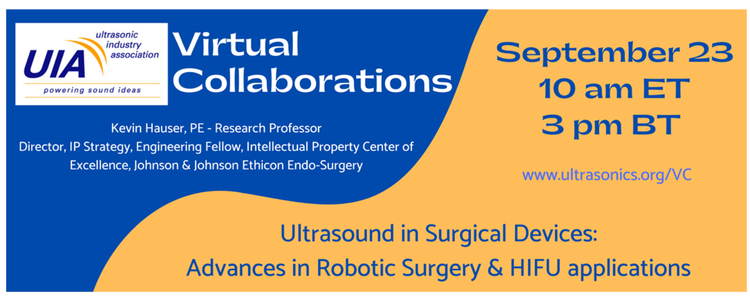
VISIT US AT ULTRASONICS.ORG

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



23 September 2021: Virtual Collaborations - Ultrasound in Surgical Devices

February 2022: Virtual Collaborations

25 - 27 April 2022: UIA50, Warwick University, UK

June 2022: Virtual Collaborations

September 2022: Virtual Collaborations Mini Symposium

November 2022: Virtual Collaborations