Volume 26, Issue 1: Winter 2016 Winter 2016

Vibrations

Powering Sound Ideas

UIA45: Seattle, Washington USA

Special Points of Interest

- UIA45 Full Schedule Page 5
- Elisa Konofagou TED video Page 3
- George Keilman Abstract Page 4
- Featured Abstracts Page 6
- UIA45 Registration Information Page 7

Make your reservation at the Motif Hotel by 11 March 2016 to get the UIA rate of $189 or call 888.515.1144

UIA45 Schedule at a Glance: 4—6 April 2016

Monday: Industrial

8:30-11:30 AM: Presentations (30 Minutes each)

11:30-1:00 PM: Lunch

1:00-2:00 PM: Invited Speaker George Keilman

2:00-5:30 PM: Presentations (30 minutes each)

5:30—6:30 PM: Wine & Cheese Reception

Tuesday

8:30-10:30 AM: Workshop and Panel

11:00-12:00 PM: Exhibitor Session

12:00-2:00 PM: Poster session and Lunch

2:00-5:00 PM: Tour of Univ. of Washington Ultrasonics Lab

6:30-9:30 PM: Dinner at Space Needle

Wednesday: Medical

8:30-11:30 AM: Presentations (30 Minutes each)

11:30-1:00 PM: Lunch

1:00-200 PM: Invited Speaker Elisa Konofagou

2:00-5:30 PM: Presentations (30 Minutes Each)

See detailed information on page 5

Inside this issue:

President's Message

Dan Cotter
UIA President

The emphasis on the web and real-time engagement and resources for members are viewed as key to continued success.

To the Board of Directors and members of the Ultrasonic Industry Association, I wish you a very happy new year.

The team is focused with leadership from Tom Matula and Dominick DeAngelis, and working to bring a historical best in the 45th UIA Symposium, Seattle, WA on April 4-6th 2016. Organization of the meeting with very early acceptance of keynote speakers, Elisa Konfogou and George Keilman for the medical and industrial sessions has been followed by an array of quality abstracts from many local researchers and entrepreneurs, as well as submissions from contributing members from around globe. Please register early and plan your participation at the Seattle Symposium.

In brief, firsts for UIA this year include the combined volume in Physics Procedia edited by Margaret Lucas and Enrique Rivera, available on line at http://www.sciencedirect.com/science/journal/18753892/63. Ron Manna is editing the second volume that will combine UIA 44-45th Symposiums. Efforts of the editors and board members reviewing these manuscripts are creating volumes with utility and purpose for those in the field of ultrasonics. The UIA Three Year Planning Committee with leadership of Matt Short and EWI enabled the first implementation of Sound Solutions: a forum of the Ultrasonic Industry Association for problem solving. Matt, Karl Graff, and many contributors participated in the successful meeting at EWI in Ohio this past October. It was a focused and topical meeting, and provided more time and depth in the subject areas, complementing the annual symposium. Plans are beginning for Sound Solutions 2016, including organizational meetings to be held at the symposium to get a head start and grow the mid-year meeting. A new sponsorship program was rolled out by the committee that enables vendors, member companies, and consultant and service providers to reach customers in the ultrasonics industry. The effort has had early success with about a 12% increase in UIA annual revenue with the first major sponsors. Rasmas Lou-Moeller is maintaining the spreadsheet on contact with vendors, and please support his efforts. The web and planning committee (Mentor Robert Muratore, leadership of Prakash Manandhar, and inputs from Fran, et al.) initiated the update of the UIA web site, complete with banner adds, sponsor recognition, and tremendous opportunities for technical content and real-time member engagement. The emphasis on the web and real-time engagement and resources for members are viewed as key to continued success. The main page of the web should be up imminently, and the development to specification will progress.

I believe the challenges to organizations such as UIA today include systemic changes in participation of members or potential members, as well as the increased significance in expenses relative to income for participants and the organization. In forward thinking, I believe real-time engagement and resources for members, management of expenses, and perhaps alternative forms of engagement are the keys. Jay Sheehan and others continued to grow the membership such that historical highs could be returned. Revenue in 2015 from membership and symposium combined to a record level, but expenses were high, too high. The finance committee is better detailing, tracking, and managing symposium expenses. It is clear that technical strength of the annual symposium, increased membership, sustaining membership, and web-based engagement will play a role in continuity of UIA.

If you have time to contribute to the initiatives of the planning committee and board, please send me an email, and I can readily direct you. The focus of the planning committee and team has shifted to symposium, but we will have some ad hoc meetings.

- Web implementation and utility
- Sound Solutions 2016
- Munich Symposium 2017
- Outreach to students, related organizations or societies, and topical meetings.

UIA should have a great year in 2016.

Elisa Konofagou: UIA 45 Invited Speaker

Safe and Localized Blood-Brain Barrier Opening using Focused Ultrasound

Current treatments of neurological and neurodegenerative diseases are limited due to the lack of a truly non-invasive, transient, and regionally selective brain drug delivery method. The brain is particularly difficult to deliver drugs to because of the blood-brain barrier (BBB). The impermeability of the BBB is due to the tight junctions connecting adjacent endothelial cells and highly regulatory transport systems of the endothelial cell membranes. The main function of the BBB is ion and volume regulation to ensure conditions necessary for proper synaptic and axonal signaling. However, the same permeability properties that keep the brain healthy also constitute the cause of the tremendous obstacles posed in its pharmacological treatment. The BBB prevents most neurologically active drugs from entering the brain and, as a result, has been isolated as the rate-limiting factor in brain drug delivery. Until a solution to the trans-BBB delivery problem is found, treatments of neurological diseases will remain impeded. Over the past decade, methods that combine Focused Ultrasound (FUS) and microbubbles have been shown to offer the unique capability of noninvasively, locally and transiently open the BBB so as to treat central nervous system (CNS) diseases. Four of the main challenges that have been taken on by our group and discussed in this paper are: 1) assess its safety profile, 2) unveil the mechanism by which the BBB opens and closes, 3) control and predict the opened BBB properties and duration of the opening and 4) assess its potential in neurotherapeutics. All these challenges will be discussed, findings in both small (mice) and large (non-human primates) animals will be shown as well as its clinical potential.

Click on the photo above to hear Elisa Konfagou's TED talk about Going Beyond Traditional Applications of Ultrasound. Elisa Konofagou is with the Department of Biomedical Engineering, and Department of Radiology, Columbia University, New York, NY

George Keilman: ULA45 Invited Speaker

George Keilman is Co-Founder & CTO of Sonic Concepts, Inc. Bothell, WA

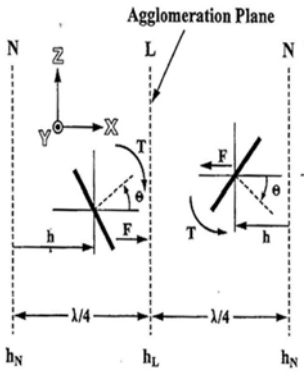


Figure 1. Acoustic radiation force and torque acting on rigid cylinders in a standing-wave field.

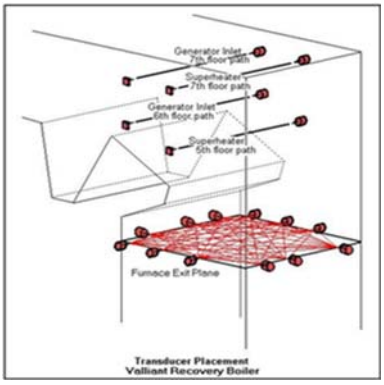
Ultrasonic technology has been applied in a wide range of industrial areas. This presentation will focus on the novel operating principles behind some new and less common industrial applications. Possible future application areas based upon these operating principles will be discussed.

A brief historical overview of ultrasonics in the Pacific Northwest will be given, including academic research groups, government labs, and industrial companies.

Several applications will be discussed that have their origins in the pulp and paper industry. In the first application, acoustic standing waves are used to fractionate wood fibers by length into different grades, in order produce higher-quality paper products. In Figure 1, a standing wave is established between two boundaries. Fibers (dark bands) are subjected to acoustic radiation force and also to acoustic radiation torque. Radiation force brings the fibers to a central agglomeration plane, while radiation torque rotates the fibers to that they are aligned vertically in the diagram. It will be shown that, in a more complex implementation, several bands of agglomeration can be generated, each containing a different fraction of fiber size. Related concepts will be presented.

In a second application also from the pulp and paper industry, acoustic pyrometry is used to measure the temperature profiles in real time in high-temperature exhaust flues. By using sensors along multiple acoustic paths, the 2D thermal profile is tomographically reconstructed. This method provided continuous 24/7 measurements with high reliability, with no practical upper limit on the temperatures that can be measured. In Figure 2, typical sensor placement is shown, along with a reconstructed 2D thermal profile.

In an application from the hydroelectric industry, acoustic scintillation is used to accurately measure the volumetric water flow at a large turbine intake. Accurate water flow measurements are needed under a wide range of operating conditions so that the facility operator can adjust turbine settings to optimize electric power production vs. water flow rate and hydrostatic head. Acoustic scintillation, i.e., the minor fluctuations in ultrasonic signal amplitude as pulses transit the flow channel, arise due to turbulent eddies in the flowing water. By spacing pairs of transducers a known distance apart, the scintillation that occurs on the two paths can be correlated to produce a time delay measurement for water flowing in the channel, as shown in Figure 3. By using multiple sets of transducers spanning the intake, the velocity profile of the flowing water can be measured and integrated to compute total volume flow.



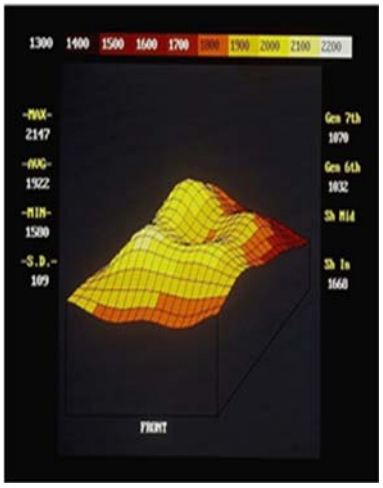


Figure 2. Acoustic pyrometry. Note sensor placement (above), and temperature profile reconstruction (below). Figure courtesy of EnerTechnix.

Further applications from other industries will also be presented. Topics include an acoustic pump, an underwater communication link, and the use of Lamb waves to measure mechanical properties of fiber composite sheet materials. The intent is to stimulate discussions about the operating principles, and their possible applications in other fields.

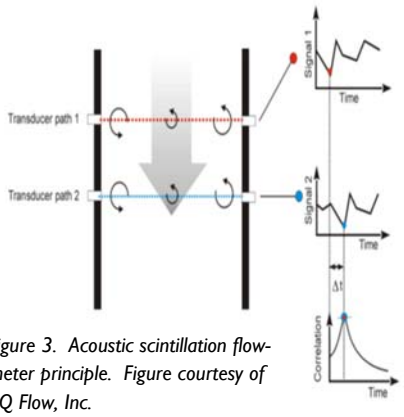


Figure 3. Acoustic scintillation flow-meter principle. Figure courtesy of AQ Flow, Inc.

UIA45 Full Schedule

Monday - Industrial

8:30-9:00 AM: High frequency ultrasonic transducers for industrial applications *(Tomasz Zawada)*

9:00-9:30 AM: Bubble dynamics near the inertial cavitation threshold under hybrid excitation *(Mark Hodnett)*

9:30-10:00 AM: Finite element analysis evaluation of an ultrasonically-assisted injection molding machine *(Matt Moles)*

10:00-10:30 AM: Refreshment/Exhibit Break

10:30-11:00 AM: An ultrasonic compactor for oil and gas exploration *(Andrew Feeney)*

11:00-11:30 AM: Evaluating the High Power Performance of Half-wave Langeven Style Transducers With PZT4, PZT8, and Single Crystal PMN-PZT Drive Stacks *(George Bromfield)*

11:30-1:00 PM: Lunch

1:00-2:00 PM: Unusual Applications of Ultrasound in Industry *(Invited Speaker: George Keilman)*

2:00-2:30 PM: Performance of PZT8 Versus PZT4 Piezoceramic Materials in Ultrasonic Transducers *(Dominick DeAngelis)*

2:30-3:00 PM: An ultrasonic caliper device for measuring acoustic nonlinearity *(Christopher Hunter)*

3:00-3:30 PM: Refreshment/Exhibit Break

3:30-4:00 PM: Characterization of airborne ultrasound fields using Refracto-Vibrometry *(Klaus V. Jenderka)*

4:00-4:30 PM: Development of a Novel Ultrasonic Resonator for Ballast Water Disinfection *(Hafiiz Osman)*

4:30-5:00 PM: Laser Doppler Vibrometry for Ultrasonic Applications *(Eric Lawrence)*

5:00-5:30 PM: Novel Round Energy Director for use with Servo-Driven Ultrasonic Welder *(Leo Klinstein)*

5:30—6:30 PM Wine & Cheese Reception

Tuesday

8:30-9:30 AM: Workshop on Emerging Ultrasonic Resonance in Cell Microtubules, with applications in Oncology *(Jack Tuszynski)*

9:30-10:30 AM: Panel On Therapuetic Ultrasound in Seattle Region including:

- Experiences in Therapeutic Ultrasound Product Development *(Jens Quistgaard)*
- Group questions and discussion

10:30-11:00: Refreshment break

11:00-12:00 PM: Exhibitor Session

12:00-2:00 PM: Poster Session & Box Lunch

2:00-5:00 PM: Tour of University of Washington Ultrasound Laboratory

6:30-9:30 PM: Dinner at Space Needle

Seattle Space Needle

© Howard Frisk

Wednesday - Medical

8:30-9:00 AM: Technology to reposition kidney stones with ultrasound *(Mike Bailey)*

9:00-9:30 AM: Histotripsy for liquefaction of large extravascular hematomas for fine-needle aspiration: feasibility study *(Tatiana Khoklova)*

9:30-10:00 AM: Sono-fragmentation in sample preparation for biological assays *(Tom Matula)*

10:00-10:30 AM: Refreshment/Exhibit Break

10:30-11:00 AM: Hybrid cutting of bio-tissue in Microtomy *(Dong Wang)*

11:00-11:30 AM: Power ultrasonic bone biopsy needles *(Andrew Mathieson)*

11:30-1:00 PM: Lunch

1:00-2:00 PM: Safe and Localized Blood-Brain Barrier Opening using Focused Ultrasound *(Invited Speaker: Elisa Konofagou)*

2:00-2:30 PM: Design of HIFU transducers to generate specific nonlinear ultrasound fields *(Vera Khoklova)*

2:30-3:00 PM: A high power therapeutic phased array system for noninvasive renal denervation *(Tong Li)*

3:00-3:30 PM: Refreshment/Exhibit Break

3:30-4:00 PM: Evidence for trapped bubbles as the cause for the color Doppler ultrasound twinkling artifact *(Julianna Simon)*

4:00-4:30 PM: Burst wave lithotripsy: A noninvasive method to fragment kidney stones with sinusoidal ultrasound pulses *(Adam Maxwell)*

4:30-5:00 PM: A clinical field-test device for verifying the acoustic power and system performance of a high-power, therapeutic, focused ultrasound system *(Josh Doherty)*

5:00-5:30 PM: An automated algorithm for measurement of surgical tip excursion in ultrasonic vibration using the spatial 2-dimensional Fourier transform in an optical image *(Prakash Manandhar)*

Featured UIA45 Presentations

Evaluating the High Power Performance of Half-wave Langevin Style Transducers With PZT4, PZT8, and Single Crystal PMN-PZT Drive Stacks

George Bromfield is Owner of Piezo innovations LLC in Salt Lake City, Utah, USA

Mathieson et.al. studied the influence of piezoelectric stack location on nonlinear behavior of Langevin transducers (IEEE Transactions on Ferroelectrics, and frequency Control, Vol,60,No 6, June 3013). The study investigates three half-wavelength transducers, each with a different piezoelectric stack location. They concluded that the modes of vibration are more responsive when the piezo stack is located at the nodal plane. Their report illustrated increasing non linearity as the drive level was increased. This represents a potential design limitation in that the resonant frequency can suddenly shift and exhibit a hysterics effect. Also the impedance increases resulting in a loss of power.

In this presentation it is assumed that the behavior of the piezo stacks is linear and can therefore be modeled using the PiezoTran transducer analysis software. The objective is to more subjectively determine the practical design limitations of transducers with the three design geometries illustrated in Mathieson's report. The scope has also been extended from PZT4 stacks to include PZT8 stacks and PMN-PT single crystal stacks.

Technology to Reposition Kidney Stones with Ultrasound

Michael Bailey, Bryan Cunitz, Barbrina Dunmire, Adam Maxwell, Philip May,1 Oren Levy,2 Hunter Wessells,1 Mathew Sorensen, 1 Jonathan Harper

1 University of Washington Applied Physics Lab, 1 UW Department of Urology, and 2 SonoMotion, Inc.

Work supported by NIH NIDDK grants P01DK043881, R01DK092197, and R44DK107094 and National Space Biomedical Research Institute through NASA NCC 9-58.

Purpose of review Ultrasonic propulsion of kidney stones is a novel technique that uses short bursts of focused ultrasonic pulses to reposition stones transcutaneously within the renal collecting system and ureter. The purpose of this review is to discuss the initial testing of effectiveness and safety, directions for refinement of technique and technology, and opinions on clinical application.

Recent findings
Ultrasonic propulsion was used painlessly and without adverse effects associated with treatment. Kidney stones were repositioned in 14 or 15 human subjects without restrictions on patient size, stone size, or stone location. The initial feasibility study showed applicability in a range of clinically relevant situations including: facilitating passage of residual fragments following ureteroscopy or shock wave lithotripsy, dislodging a large obstructing stone at the uretero-pelvic junction for pain relief, and diagnostically differentiating large stones from a collection of fragments. Preclinical studies with a range of probes, interfaces, and outputs show room for increased outputs and refinement of specific applicators for specific treatment needs of the urologist, emergency department physician, or radiologist.

Summary

Ultrasonic propulsion of kidney stones shows great promise as an office-based system for transcutaneously repositioning stones within the kidney and ureter. Future directions include broader beam, more powerful systems, additional clinical trials directed at clinical significant endpoints in the emergency department and urology settings and integration with a suite of ultrasound technologies including burst-wave lithotripsy.

UIA45 Workshops—Tuesday 5 April

Workshop on Emerging Ultrasonic Resonance in Cell Microtubules, with Applications in Oncology

Jack Tuszynski, Allard Chair & Professor Experimental Oncology, University of Alberta, Cross Cancer Institute

Panel On Therapuetic Ultrasound in Seattle Region

- Experiences in Therapeutiic Ultrasound Product Development *(Jens Quistgaard)*
- Group questions and discussion

Poster Session / Box Lunch

Tour of University of Washington Ultrasonics Laboratory

Evening Event

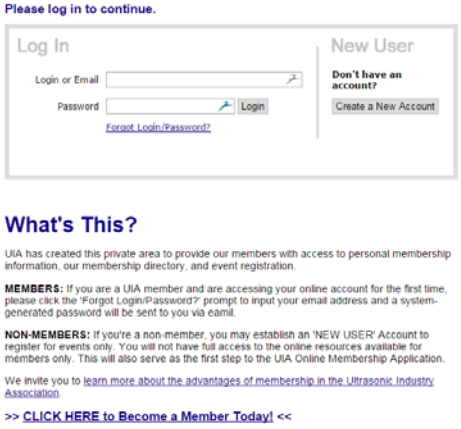
UIA will have its Tuesday evening event atop the Seattle Space Needle. You will see the 360° Seattle skyline at sunset and view thousands of lights as dusk falls

Seattle's Space Needle from the Chihuly garden *Courtesy of Seattle CVB*

UIA45 Registration Information

Register online for UIA45. Follow these instructions to assist you.

Login to your UIA account. If you've forgotten your password or are accessing your online account for the first time, please click Forgot Login/Password? to receive an email your details.



You can choose to register as a:

- ***Member***
- ***Nonmember***
- ***Exhibitor***
- ***Entrepreneur***
- ***Student***
- ***Sponsor***

Sound Solutions a Success!

Sound Solutions was held in Columbus, Ohio

20-21 October 2016

A field having such great breadth as ultrasonics presents a challenge at keeping abreast of all the endeavors in academia, applied research, industrial and medical uses, and new product developments. While the UIA Symposium highlights work in these areas, there is still more to be discussed. So the UIA responded by offering a focused workshop that delves deep into topics that have been identified by you.

The focus of the first Sound Solutions workshop was industrial applications and challenges with high power ultrasound. On October 20th, 2015, the workshop kicked off with a reception and Karl Graff's presentation on the Fundamentals of Power Ultrasonics. The event continued on October 21st at EWI's Headquarters in Columbus, Ohio. While the morning session spoke to specific uses such as welding, soldering, forming, machining, and others, non-typical presentations were also given on Automotive Light Weighting Trends, Manufacturing Trends, and Equipment and Tooling.

The afternoon session carried on as an interactive session where attendees had the opportunity to engage speakers and experts in the field on specific challenges, but also talk amongst the attendees about potential applications for future uses. The workshop concluded with a tour of EWI's facilities and first-hand look at their extensive research in industrial systems using high power ultrasonics.

The first Sound Solutions workshop was deemed a success having drawn in just under 30 attendees from across the country. There was outstanding engagement and several interesting ideas presented for potential uses. A major contributor to making this event a success was due to our sponsors, Dukane, EWI, Integra, Sonobond, and ToolTex Inc. We are grateful for your continued support.

In making this year's Sound Solutions workshop even more successful, we need to hear from you! As previously mentioned, the goal of this workshop is to specifically address topics that have widespread interest with those working with ultrasonics. We are currently in the planning stages of this year's workshop and will continue to solicit topics at UIA 45 in April. What would you like to hear more about?

-Matt Short

UIA43 Procedia Now Online

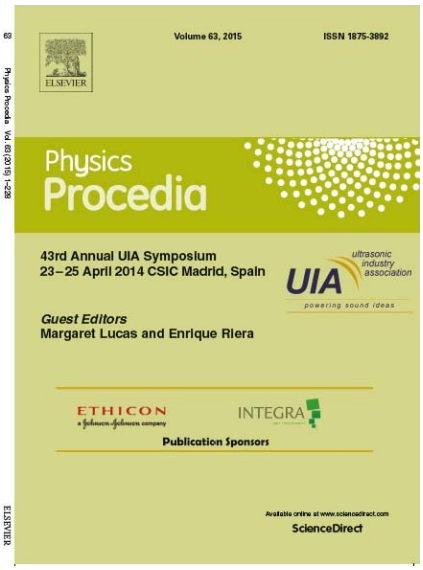
The proceedings of the UIA symposium 2014 are now available online on ScienceDirect:

http://www.sciencedirect.com/science/journal/18753892/63

This issue includes select articles from the previous two years of UIA Symposia.

There are a total of 35 articles included. It is easy to access the abstract or the entire article online and to download the articles of your choosing.

Work has begun on the UIA44 Proceedings. With the experience of our first year working with Physics Procedia, we look forward to publishing the UIA44 Proceedings prior to spring 2016.



Volume 26, Issue 1: Winter 2016

Ultrasonics Industry Association

Ultrasonics Industry Association
11 W. Monument Ave.
Ste. 510
Dayton, OH 45402

Phone: 937-586-3725
Fax: 937-586-3699
Email: uia@ultrason

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 Referral Network, learn about ultrasonics with our online primer, or meet industry leaders at our next symposium.

Important Dates

11 March:	**Last day to make your hotel reservations at Motif Hotel**
28 March:	Last day to register online for UIA45
4 - 6 April:	UIA45 at Motif Hotel in Seattle, WA
Fall 2016	Sound Solutions

The proceedings of UIA43 symposium are now available online on ScienceDirect: http://www.sciencedirect.com/science/journal/18753892/63