

Powering Sound Ideas

UIA 48: Toronto, Canada 15 - 17 April 2019

UIA is looking forward to visiting Toronto for the its 48th Symposium next April.

Jay Sheehan, Integra Life Sciences, will serve as the Chair for this Symposium. He will be working with Jahan Tavakkoli, PhD., Undergraduate Program Director, Associate Professor, Ryerson University. Plans for this symposium include:

- Tour of the Ryerson University Ultrasonic Laboratory on Tuesday



- Industrial sessions
- Medical sessions- chaired by Justin Byers, Bonutti Research and Myra Flitcroft, Moog Components Group
- Workshops and Poster Session on Tuesday

- New this year! Interactive presentations throughout the symposium.

Paper and Poster Submissions

Have a presentation idea? Abstracts for sessions can

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Special Points of Interest

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UIA47: Wrap-up

The 47th Ultrasonic Industry Association Symposium took place at the Atlanta Marriott Midtown from April 30th to the 2nd of May. **Tony Crandall** was the Symposium Chair.



Over 50 participants from several countries attended this meeting. It was great to return to Atlanta where UIA 31 had been held 17 years prior. The camaraderie

and personal interaction were exceptional this year, with technical discussions continuing long into networking sessions.

Continued on next page



UIA48 Preview, continued

now be submitted using the form included in this newsletter on page 9.

Tuesday Event at Mill Street Brewery - Located in the historic Distillery District, Mill Street are beer innovators in the Canadian brewing scene with their in-house nano-brewery, which allows them to create unique, small-batch brews.

Make Your Hotel Reservations Today!

UIA48 will be held at the InterContinental Hotel Toronto Centre. To make your reservations you can call: 1-800-235-4670 or you can book [online](#). Please note that you are attending the **UIA 2019 Annual Symposium** when booking through the 1-800 number.

Hotel rooms are just \$245C/night. [Make your reservations by 15 March 2019.](#)

UIA47: Wrap-up, continued

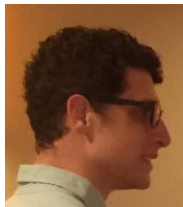
Monday, April 30th

The first day of the symposium was our Industrial Session, which board member Dominick DeAngelis chaired. UIA President Tony Crandall opened the meeting with a welcome to the attendees.

The first speaker was **Andrew Feeney** (University of Warwick, UK). He presented the results of the Centre for Industrial Ultrasonics' work on extending the use of Flexural Ultrasound Transducers (FUTs) into higher frequencies (above 50 kHz). FUTs are efficient, low cost and can couple to low-impedance media (e.g., air). Adapting them for use at high frequencies (HiFFUTs) will allow them to be used for sensing and monitoring in a variety of applications and environments.

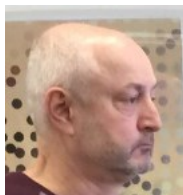


The next speaker was **Curtis Covelli** (Iowa State University).



Curtis explained why biofuels are important ecologically and economically. Ionic liquids have special solvent properties that can be used dissolve cellulose. The ultimate goal is to hydrolyze switchgrass into aqueous sugars. Ultrasonic cavitation and streaming can reduce the dissolution time from 24 hours required for heat treatment to 4 minutes! Modifying ionic liquids so they are "task specific" combined with ultrasonic treatment shows promise, but there is more work to be done.

Leo Klinstein (Dukane) then gave an update on the Latest Innovations in Ultrasonic Power Generators. Leo



reviewed the company's history of innovation and intellectual property surrounding it. He described the benefits of Power Factor Correction and its effects on the voltage and current waveforms during the weld process. The advantages of round energy directors was discussed, as was the ongoing work being done on controlling the "dynamic hold" phase of the weld.

Following the morning break, **Rasmus Lou-Møller** (Meggitt A/S,



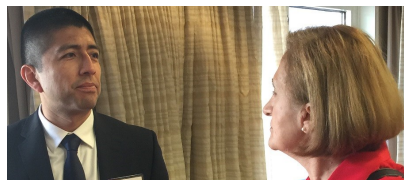
Denmark) gave a very interesting presentation on detecting ice on airplane wings with surface acoustic waves (SAWs). The program is part of the Clean Sky program (a public-private partnership between the European Commission and the aeronautics industry), which aims to reduce CO₂, gas emissions and noise. The

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UIA47 Preview: ATILA Workshop Tuesday 1 May

current sensors are probes that protrude from the plane wing and sample only a single point. SAWs could improve the ice detection system by increasing the area that is monitored and reducing the profile of the sensors. A very elaborate and clever test setup was constructed, and two rounds of prototyping and testing were performed. The first round used Navy Type I piezoceramic and showed that the method was feasible, but not reliable as configured. The second round, which used Type II ceramic, had much better results. These tests were performed using water droplets rather than ice and a single droplet could be detected. The next step will be to test the device with ice.

After a quite detailed question and answer session on Rasmus' talk, there was an "Unconference" Session. The



Joseph Luis and Olga Jovic at the Unconference

idea of the unconference is to provide time for the group to interact and discuss what's been presented, outside of the refreshment break and exhibition sessions. The conference room remained full and there were several robust and lively discussions of the morning's talks up until it was time for lunch, where the conversations continued.

Following lunch, our Industrial Session



keynote speaker, **Shashank Priya** (Penn State University), presented a very informative and interesting talk on Textured Piezoelectric Materials. Piezoelectric materials have evolved considerably, starting with barium titanate in the 1940s, followed by lead zirconate titanate (PZT) in the 50s, to doped PZTs, and finally to single crystals in the last 30 years. Textured PMN-PZT rivals the performance of single crystal ceramic, but is not as expensive. Texturing is accomplished by adding a "template" that causes grain growth in a specific direction. Textured ceramics can be cofired to make multilayer ceramic structures such as plates or bimorphs. These can be used as actuators, sensors or other applications with performance that is comparable to single crystals. Shapes, such as cylinders, can be fabricated out of textured ceramics to make high figure of merit hydrophones. Textured piezoceramics can provide high performance at low cost in a variety of complex shapes for a variety of applications.

Next **Dominick DeAngelis** (Kulicke &



Soffa) shared his findings regarding the use of perforated electrodes in piezoelectric stacks to avoid delamination. He showed several different stack designs, which were all variations of a Langevin stack that was glued. The research was undertaken to address common causes of delamination and joint losses in stacks. Using

perforated electrodes can control bond lines and decrease likelihood of delamination. Based on a review of available literature, approximately 20% of the electrode area should be perforated, and guidelines for thickness and temperature changes during curing of the epoxy will cause some shear forces on the epoxy "plugs" due to differential thermal expansion. Finite Element Analysis (FEA) was used as well as experimental testing to determine whether perforations improved the performance and reliability. The FEA and experiment results supported the use of perforated electrodes and several guidelines for designing the electrodes were provided.

Following a networking break, **David**



Grewell (Iowa State University) presented the work done at the Center for Bioplastics and Biocomposites by one of his students, Karla Lebron, in

conjunction with industry (Dukane, Branson). He discussed ultrasonic welding of polylactic acid (PLA) with the goal of being able to predict the performance of biobased welded products by understanding the thermal models and activation energy involved in the welding process. David explained the basics of welding and methods of modelling the asperities and molecular diffusion. Predictions of the temperature fields were obtained by FEA modeling and the model was compared with experimental data. The results confirmed that weld strength can be predicted from fundamental principles.

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UIA47: Wrap-up, continued

The final talk of the day was given by **Colin Souza** (University of Glasgow).

He presented the work done by the Medical and Industrial Ultrasonics Group on characterizing acoustoplasticity, which refers to



the apparent softening of metals when ultrasonic vibrations are added to plastic deformation. The effect was noticed back in 1955 and a variety of methods were used to study the effect. A number of developments led up to “full-field” strain measurement using digital image correlation with a 1µs strobe flash and a piezoelectric force transducer. The strobe method of measuring was successful. The measurement set-up will next focus on eliciting the effect of ultrasound on the plastic deformation, which was not captured in the initial tests.

The day wrapped up with a wine and cheese reception sponsored by Meggitt, where discussion of many of the day’s presentations continued.

Tuesday, May 1st

On Tuesday morning **Alfredo Vazquez Carazo** (Micromechatronics)

presented a workshop on using Atila Finite Element Analysis Software to model piezoelectric transducers. The workshop materials included provision of software and a book by Kenji Uchino. Dr. Carazo explained



how to use the software to enter models of transducers into the program and how to use the software to analyze a transducer. Over 25 people attended the workshop, and Alfredo spent time with several attendees individually helping them get the correct results on their computer. For those unfamiliar with finite element modeling, it provided a wealth of new information; for those who have used other FEA software, it was an introduction to a package designed specifically for transducers that use piezoelectric ceramic.

The workshop session was followed by a walk to the Georgia Tech Campus, where PhD student Katie Scott led the group on a tour of the campus. We got



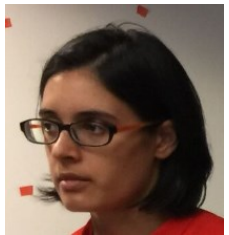
to see some beautiful architecture, and the Olympic Village and Aquatic Center that were part of the 1996 Olympic Games. After touring the general campus we went to the Love Building and were given tours of two labs. One was Dr. Jun Ueda’s Biorobotics and Human Modelling lab where student Waiman Meinhold showed us the work being done on imaging the vertebral discs in humans and other projects being investigated in the lab. The other lab we visited was Dr. Alper Erturk’s Smart Structures and Dynamical Systems Laboratory. Student David Tan led us on a tour and Dr. Erturk gave a very interesting presentation on some of the work being done there on nonlinear systems.

For the traditional Tuesday night banquet, the group walked to the Lure restaurant for a night of incredibly delicious seafood dinner, drinks and conviviality.

Wednesday, May 2nd

Medical Session co-chair, Dan Cotter opened the meeting and introduced the first speaker, **Nina Vyas** (University of Birmingham) who

presented a talk on cavitation in dental ultrasonic cleaning. Ultrasonic scalers are used for a variety of dental



clinical procedures. Cavitation is thought to play a role in these, particularly biofilm removal. In order to understand the effect cavitation has, it needs to be detected and analyzed. High speed imaging was used to visualize and measure the cavitation clouds, and laser vibrometry was used to measure the tip displacement of the scaler. Having shown that the cavitation could be characterized, means for increasing cavitation were explored. The shape of the tip was varied by creating a flattened section. Cavitation was imaged and the acoustic pressure was modelled. Tip shape will affect the cavitation, and further work needs to be done to maximize the effect.

Next, **Jeff Vaitekunas** (Penn State University), a past UIA president, opened his talk by reminiscing about the last time the UIA symposium had been in Atlanta. It was in October of 2001, just

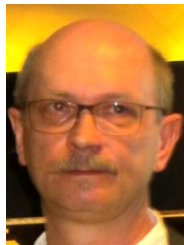


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UIA47: Wrap-up, continued

after “9-11” and Jeff had just taken over as President. Jeff then spoke on defining the critical bend radius in thin waveguides. There is a region along the guide where motion is primarily longitudinal and then a region distal to that where the motion becomes transverse. The amplitude can be broken into three regions: at the transducer, just proximal to the bend and then the active distal section. If the bend radius is small, the wave can be reflected and high amplitude standing waves can occur in the second region and cause the wire to break. If the bend is sufficiently larger, it is transparent to the wave. The bend diameter is a function of frequency so increasing frequency allows for smaller diameters. Jeff’s talk stimulated many questions, and the discussion continued through the morning break.

Following the break, **Klaus-V. Jenderka** (University of Applied Sciences, Merseburg, Germany) reviewed sound field simulation tools. There are a number of software programs available for calculating and simulating ultrasound fields, and many of them are freeware. Klaus reviewed the basic theory, showed the output of simulations and compared it to measured values. Field II, which works with Matlab, can be used to model sound fields from single elements or arrays. K-Wave also works with Matlab and can simulate both single elements and arrays. PZFlex is a finite element based software with wizards and tools to accommodate multiple transducer



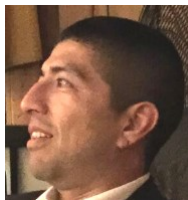
configurations. Each program has its strengths, with k-wave and PZFlex being a bit more versatile than Field II.

Klaus’ talk was followed by a forum on three Medical Ultrasonic Applications.

Justin Beyers (Bonutti Technologies) presented work done on commercializing Osteoweld, which is a procedure for ultrasonically welding a PEEK intramedullary nail into a titanium shaft with a PEEK overmold for fixation of the ulna after a fracture. The details of the development, procedure and regulatory pathway were discussed. The procedure offers an alternative to metal screws inserted into metal shafts which requires multiple x-rays to align the screw with the socket in the shaft.



Joseph Luis (Merz Aesthetics) discussed “Ultherapy” which is a method of skin lifting using focused ultrasound, which creates thermal coagulation points (TCPs) beneath the epidermis. This creates an inflammatory response that causes the tissue to heal and cross link, ultimately tightening the skin and reducing wrinkles. The device causes lesions in three layers below the epidermis to cause the “lift”. The procedure is done in office with no recovery time. Examples of the outcomes were presented.



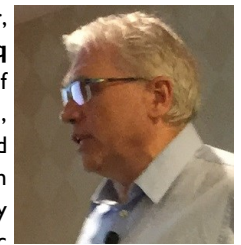
Next **John Bertorelli, Dan Cotter,**



and Jay Sheehan (all from Integra) discussed the intricacies of ultrasonic surgery in the brain and liver. The details of the surgery, development and regulatory submissions were discussed. Confidentiality prevents further discussion in this article.

The forum took us up to lunch, which was followed by our Medical Session invited speaker,

Marc Lethiecq (University of Tours, France), who presented work done on high frequency ultrasonic transducers for ultrasonic biomedical microscopy (UBM). Above 20 MHz higher resolution can be achieved at the expense of lower penetration. This is appropriate for many applications, (e.g. ophthalmology). Several technologies can be used to create UBM transducers. All require high coupling and low acoustic impedance. Piezopolymer based transducers work well for single element transducers. Thick film printed transducers can be used to make transducers of various shapes and sizes at reasonable cost. Examples of high resolution images created with this technology were shown. A third fabrication method is I-3 composites, which allows for array development. High frequency (30 MHz) annular and



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UIA47: Wrap-up, continued

linear arrays have been constructed and the high resolution images from these were shown. Another transducer technology that is useful at these frequencies is Capacitive Micromachined Ultrasonic Transducers (CMUTs). High resolution skin and eye imaging examples were shown. Marc concluded his talk by inviting the audience to attend the International Conference on Biomedical Microscanning this fall.

Our next speaker, **Timo Scholehwar**

(PI Ceramic, Germany) presented a very enlightening talk on failure modes in piezoelectric transducers. He discussed both field failures and production



failures. The majority of field failures are due to delamination, which implies incorrect glue selection or technique. There is a large variety of possible production problems caused by processing, handling, storage and improper manufacturing techniques. Ceramics should not be exposed to tensile stress, which can happen if surfaces are uneven or not flat enough. Incorrect soldering techniques result in a joint where the electrode is lifted off the ceramic. Correct technique is to use a very short soldering time. Adhesion problems can be as simple as not applying enough glue. Timo showed many pictures and examples and the talk was very useful and informative.

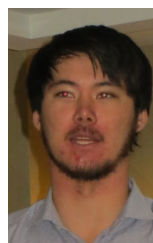
Myra Flitcroft (Moog) then presented

the work done by George Bromfield and her on evaluating the performance of high power Langevin medical transducers. Key



performance indicators were defined as coupling coefficient and reserve power. Myra reviewed Berlincourt's work on logarithmic aging of PZT and compared the experimental data collected to the theory. The measured ageing rates were found to be higher than the values listed by the manufacturer, but followed Berlincourt's findings. Reserve power for dry vs. epoxied stacks was measured and found to be higher for dry stacks, but the difference might be due to other effects.

Our final speaker was **Waiman Meinhold** (Georgia Institute of Technology). He presented his group's work on a frequency tunable actuator



for imaging human intervertebral discs. The goal was to design an actuator for Magnetic Resonance Elastography (MRE) meeting several criteria required to effectively image discs. A silicone disc phantom was created for the testing. In order to be MRI compatible, the actuator had to use all non-ferrous material. A piezoelectric actuator using a 3D rhombus design was proposed as the solution.

UIA outgoing President and Symposium Chair, Tony Crandall closed the program concluding an outstanding symposium (See Presidents' Messages on page 7) The UIA would like to thank all those who contributed as speakers, chairs, exhibitors, sponsors and attendees for making this the exceptional program that it was.



Tony Crandall accepts recognition for his two years as UIA President from Dominick DeAngelis, incoming UIA President.

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UIA48

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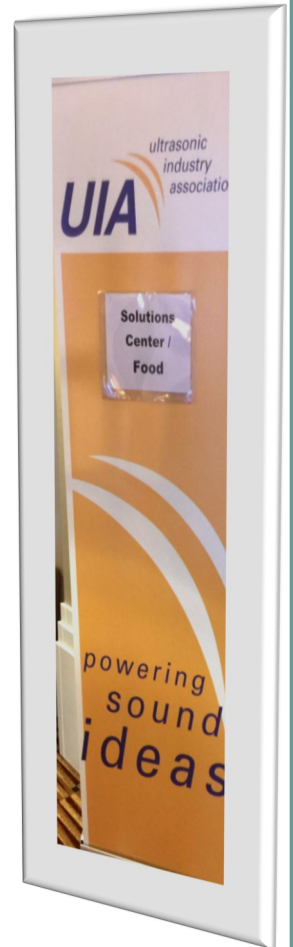
UIA2019

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Changing of the Guard for UIA

After serving as UIA President since 2016 and overseeing two successful conferences - UIA46 in Dresden, Germany and UIA47 in Atlanta, GA, USA, Tony Crandall is relinquishing the gavel to Dominick DeAngelis. Dominick first attended the UIA Symposium in Washington DC in 2008, and has served as symposium session chairs and on the board of directors.

Tony Crandall, UIA President 2016-2018

Two years ago, at the UIA Symposium in Seattle, I took over the presidency of the organization from Dan Cotter. Taking the helm of such a great organization was exciting, but following the hard work that Dan and Mark Hodnett before him had done to grow and improve the UIA was a bit daunting. I've been involved in the UIA for over 20 years and have seen it grow and evolve, as has the field of ultrasonics itself. The members of the UIA represent some of the best engineers and scientists in the field and it has been an honor and pleasure to know and interact with them, both as friends and colleagues. To be able to refer to myself as president of this group has truly been an honor and I thank the board of directors and the membership for your support.

Years ago at a symposium a new attendee came up to me at a poster session and we started talking about some of the intricacies of transducer design. That interaction started a dynamic and interesting relationship and friendship that continues today. The attendee was Dominick DeAngelis, our new president. Dominick has contributed to the UIA as a speaker, board member, session chair, symposium chair and just about anything else he's been asked to do. Whenever I've needed someone to jump in and help, he's done it. Dominick brings a passion to the things he does that I'm sure will make his tenure as president exceptional. I am proud and excited to welcome Dom as our new president and ask all of you to support him as you have me.



Dominick DeAngelis, UIA President 2018 -

I would first like to start-off by thanking our outgoing president Tony Crandall for all his time and dedication serving the UIA during the past two years; Tony has not only been a great leader, but has also been a great friend and mentor of mine over the past 10 years that I have been involved with the UIA. I can honestly say that from everyone I have ever met at the UIA, I have learned the most from Tony (and not just about ultrasonics ;-); I feel extremely grateful for his willingness to share his valuable knowledge with me!

When I attended my first UIA symposium in 2008 (DC), I never imagined I would ever serve on the board, or let alone become president for that matter, but the UIA has a way of drawing you in and getting you involved; the very casual hobnob experience was unlike any other conference I had ever been to. Over the years I have found that the value of the knowledge learned at the symposiums is often worth many times the price of admission. This includes not only the presentations, but also especially from all the networking opportunities that occur during the session breaks with the UIA's tight-knit group of world class engineers and researchers. For example, when I was asked by my company to convert all of our ultrasonic transducers from leaded solder to lead-free solder, I expected a protracted research study, but instead I just asked the UIA experts to find out which alloys they had found worked the best, and was up and running in weeks.

What I love about the UIA symposiums is the broad array of different presenters in ultrasonics they attract, ranging from fundamental materials research, ingenious applications to practical transducer design,

Continued on next page

From the President, continued

and from diverse fields such as medical, semiconductor or industrial. What is quite remarkable is that I often learn the most from the researchers that work outside my field (e.g., who knew the way bats and whales use sonar is amazing!). The presentations are geared toward a more general audience with ultrasonics knowledge, but for researchers that do not necessarily work in your particular field. As a result, nearly all the presenters provide enough details for most to follow, and in case you missed anything, you are also sent home with copies of all the presentations! I cannot tell you how valuable this has been for future reference, and how often they have spawned new research ideas.

As I look to the future, my goal is not to change the UIA in any substantial way, but to sustain the distinguished organization by making tweaks and improvements. I am very thankful to have the continued support from our current Vice President, Margaret Lucas, and also from our very active past presidents Tony Crandall, Dan Cotter and Mark Hodnett, as well as all the other great members of our board, including our Executive Director Fran Rickenbach who makes it all possible. My current focus will be supporting our energetic symposium chair Jay Sheehan for the upcoming 2019 symposium in Toronto, Canada, as well improving the publication of our symposium proceedings for better visibility of the UIA.

Dominick DeAngelis
UIA President

*Over the
years I have
found that
the value of
the
knowledge
learned at the
symposiums is
often worth
many times
the price of
admission*

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UIA48 Call for Papers/Posters

Here's your opportunity to share your latest research and applications with the ultrasonic community. We welcome traditional presentations (25 minutes in length) and posters. On Tuesday, we feature workshops on ultrasonic principles. Here are the instructions for our online [Paper Submission Process](#).

On the Abstract Submission Home Page, you first need to set up your profile (1) before submitting your abstract (2)

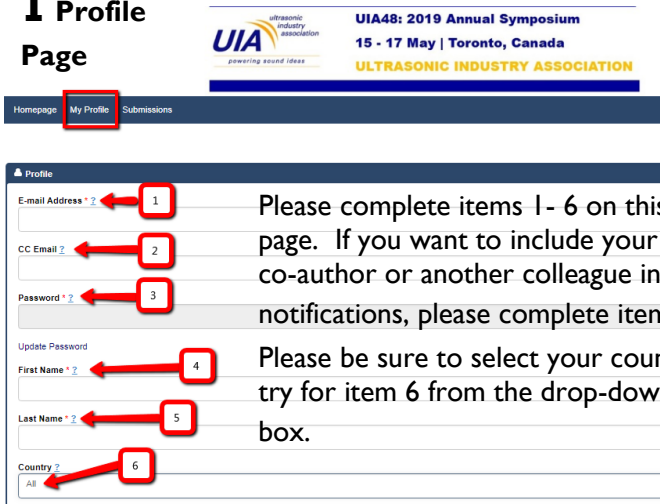


The UIA invites abstract submissions for posters for the 48th Annual UIA Symposium, 15 - 17 April 2019, in Toronto, Ontario, Canada. This is an opportunity to showcase your research results to academic and industry delegates in any area of medical or industrial ultrasonics. We would be delighted to receive poster abstracts from graduate students to bring a strong 'local research' flavor to the UIA Symposium. You can submit your abstract here. We look forward to seeing you in Toronto. We welcome your submission for UIA48. You may submit for one or more of the following:

- Industrial Session
- Medical Session
- Workshop Session
- Poster

If you are selected to present a paper, you will have no longer than 25 minutes to do so. We allocate up to 60 minutes for a workshop session. Posters will be displayed on Tuesday with an opportunity to discuss with interested individuals

1 Profile Page



Please complete items 1 - 6 on this page. If you want to include your co-author or another colleague in notifications, please complete item 2.

Please be sure to select your country for item 6 from the drop-down box.

2 Submission Page Instructions

After completing your profile, you are ready to upload your submission.

2: Select if your presentation is industrial, medical, workshop, or poster.

Items 3, 4 and 5 will be used for publicity purposes - please ensure their accuracy.,

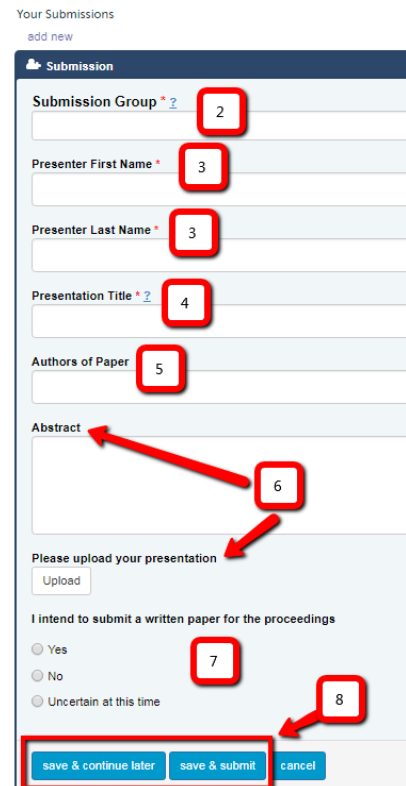
Item 6 - you can either cut and paste your abstract OR upload it.

Item 7 - your interest in publishing your paper will not affect the decision to accept your presentation.

After completing items 1 - 7, you MUST select **save & submit**.

Please note you can save what you have and return to submit later.

2 Submission Page



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

Phone: +1.937.586.3725
uia@ultrasonics.org



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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

31 October 2018: Presentation Abstract Submission Deadline

15 March 2019: Last day to make your reservations at the InterContinental Hotel Toronto Centre [UIA48 Hotel Reservations](#)

15 - 17 April 2019: UIA48 in Toronto, ON, Canada