FUSE CDT
Future Ultrasonic Engineering

The EPSRC Centre for Doctoral Training in Future Ultrasonic Engineering

Annual Scientific Meeting 2022

Programme

21-22 June 2022 - Glasgow, UK

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Day 1 - Tuesday 21st June

Time	Duration (mins)	Session	Presenters
09:15 – 10:00	45	**Registration / Networking**	
10:00 – 10:05	5	Welcome from Morning Chair	Olubunmi Onanuga
10:05 – 10:30	25	CDT Directors Up-date	FUSE Co-Directors Prof. Sandy Cochran & Prof. James Windmill
10:30– 11:15	45	Academic Presentations 1	Dr Joanne Cleland Dr Rebecca Cleary Prof. Martin Lavery
11:15 – 11:30	15	**BREAK**	
11:30 – 12:30	60	Keynote Speaker	Prof. Dugald Cameron, OBE Artist and Industrial Designer
12:30 – 13:25	55	**LUNCH**	
13:25 – 13:30	5	Welcome from Afternoon Chair	Jayden Tomkinson
13:30 -14:00	30	External Partner Presentations 1	Thales – Dr Laura Stoica CeramTec – Liam Dillon
14:00 - 14:30	30	Round 1 of Table Discussions & Poster Presentation	FUSE students
14:30 – 14:45	15	**BREAK**	
14:45 - 15:15	30	Round 2 Table Discussions & Poster Presentations	FUSE students
15:15 – 16:00	45	'Life Beyond The PhD' Discussion Panel	Dr Holly Lay Dr Theodosia Stratoudaki Dr Nico Fenu Dr Steffan Gwyn Chaired by: Prof. Margaret Lucas
16:00 – 16:55	55	External Partner & Outreach Team Exhibit	Sponsoring External Partners FUSE Outreach Team
16:55 – 17:00	5	Closing comments	Chair & FUSE Directors
19:00 – 21:00	120	**FUSE Dinner**	

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Day 2 - Wednesday 22nd June

Time	Duration (mins)	Session	Presenters
9:15 -10:00	45	**Registration / Networking**	
10:00 – 10:05	5	Welcome from Day 2 Chair	Ben Jacobson
10.05 - 10.15	10	EPSRC Up-date	Will Gompertz (V)
10:15 – 10:45	30	Academic Presentations 2	Dr Ehsan Mohseni Dr Koko Lam (V)
10:45 – 11:00	15	**BREAK**	
11:00 – 12:00	60	Keynote Speaker	Prof. Lorena Pardo (V) Madrid Materials Science Institute
12:00 – 13:00	60	**LUNCH**	
13:00 – 13:15	15	External Partner Presentations	Novosound – Dr Claire Thring
13:15 - 13:45	30	Round 3 of Table Discussions & Poster Presentations	FUSE Students
13:45 – 14:00	15	Close of Annual Scientific Meeting	Chair & FUSE Directors
14:00 – 16:00	120	**Social Activity**	

V = Virtual Presentation

For those joining the social activity, please download the app using this link: https://wearewildgoose.com/my-events/e5962834a750564e

CDT Director's Update

We start our annual meeting with a brief overview of FUSE CDT in the last year. This will be presented by our directors Prof. Sandy Cochran (he/him) from the University of Glasgow and Prof. James Windmill (he/him) from the University of Strathclyde.

Academic Presentations 1

Dr Joanne Cleland (she/her) - Ultrasound Tongue Imaging for Speech

Dr Cleland has been at the University of Strathclyde since 2015 where she teaches undergraduate courses in Speech and Language Pathology. She is an HCPC registered Speech and Language Therapist with a PhD in Communication Disorders, and has a particular interest in clinical phonetics and articulatory analysis using ultrasound tongue imaging. Her work uses visual biofeedback techniques for the assessment and treatment of motor speech disorders. Furthermore, she is interested in research which looks at speech disorders in children, particularly in children with developmental disabilities. Her work also explores motor speech disorders occurring in autism spectrum disorder, Down syndrome, cleft lip and palate, and persistent speech sound disorders.

Dr Rebecca Cleary (she/her) – Unlocking the Future of Ultrasonic Surgery

Dr Cleary is a postdoctoral researcher within Centre of Medical and industrial Ultrasonics within the School of Engineering of the University of Glasgow. Dr Cleary has been realising a new technique for the surgical treatment of the petrous apex using ultrasonically resonating needles. Her research is conducted in partnership with an NHS ENT surgeon and the medical device unit of the NHS. This has ignited an interest in investigating additive manufacturing techniques for the metal components of high power ultrasonic devices. Moving forward she will be conducting an investigation into tailoring the material properties of titanium and steel alloys to promote acoustic wave propagation.

Prof Martin Lavery – Vortex beam interactions for the measurement of nonlinear acoustic behaviour

Martin Lavery is a Professor, Royal Academy of Engineering research Fellow and leader of the Structured Photonics Research Group at the University of Glasgow. He is focused on applying novel physical phenomena to industry-inspired engineering challenges, including the development of state-of-the-art Space Division Multiplexed communication systems, novel studies into the propagation dynamics of structured light in turbulent environments, and an ultra-wide field of view solar collection optics, and bespoke acoustic wavefront shapers.

Keynote Speaker

Prof. Dugald Cameron, OBE - Making Waves

Professor Dugald Cameron, OBE FCSD FRSA is a Scottish artist and industrial designer. Cameron was born in Glasgow in 1939 and raised near Clydebank, attending the High School of Glasgow. He obtained both a DA and a Postgraduate Diploma from Glasgow School of Art. He subsequently worked as a freelance industrial designer, during which time he designed a prototype medical ultrasound machine, the Lund machine (aka the Sundén machine, after Bertil Sundén of Lund University, who commissioned it), and the production version, the Diasonograph, working with medical physicist Tom Brown.

He is an Honorary Professor in the Department of Aerospace Engineering at the University of Glasgow and a Visiting Professor at the Department of Design, Manufacturing and Engineering Management at the University of Strathclyde.

External Partner Presentations 1

Thales

Dr Laura Stoica (she/her) - Upgrading Underwater Acoustic Technology

Thales is a team of over 6,500 experts, including 4,500 highly skilled engineers, across nine key UK sites. They have unrivalled experience across every major industry they serve - working around the clock to make life better and to keep us safer. They're a global technology business operating across aerospace, defence, digital security, transport, and space.

CeramTec

Liam Dillon (he/him) - Lead-free ceramics in Ultrasonic Technologies

CeramTec is a leading developer and globally active manufacturer and supplier of special solutions made of advanced ceramics with more than 3,400 employees. Our solutions are used worldwide in automotive and mechanical engineering, medical technology, electronics, aerospace technology and energy and environmental technology.

Table Discussions & Poster Presentations 1

Maura Allan (she/her) - Towards Ultrasonic Autonomous Surgery: Robotic Deployment of Ultrasonic Surgical Tools

In recent years, there have been multiple advancements within the area of ultrasonic surgical devices and within robotically-assisted surgery, with the da Vinci surgical system being the best known. However, many current robotically assisted surgeries take place at lower levels of autonomy such as telesurgery or robotic guidance and there is still work that can be done to allow for fully autonomous surgery, even with respect to simple procedures. My project looks towards a system that is able to carry out simple surgical procedures without human intervention.

This project intends to create a framework of methods and techniques for the robotic deployment of power ultrasonic surgical devices – primarily, but not limited to, devices intended for hard tissue dissection. This includes:

- the optimisation and modification of existing devices for robotic deployment (including finite element analysis investigations);
- investigation of various control techniques on developmental test rigs and a 6 degree-of freedom robotic arm;
- the creation suitable robotic paths and path planning algorithms both based on the existing surgical techniques and new techniques optimised for ultrasonic devices.

This project brings together knowledge of ultrasonics, mechanical and electrical design, and control algorithm design, to allow the development of a system that will lay the foundation for ultrasonic autonomous surgery.

Panagiotis Kamintzis (he/him) - Automated Laser Ultrasonics for Inspection of Metal 3D Printing

Additive Manufacturing (AM) is an exponentially growing manufacturing technique which offers numerous advantages over alternative methods in terms of design flexibility, waste and lead-time reduction. More specifically, the Wire Arc AM (WAAM) technology enables the production of metal structures both small and large, while reducing the manufacturing duration and cost by approximately 50%. Some of the alternative, subtractive methods include forging and extensive machining which can result in higher costs and material waste.

The aim of my PhD project is the automation of remote ultrasonic inspection of components using robotic means coupled with laser ultrasonics to perform in-process Non-Destructive Evaluation during the WAAM cycle. Non-Destructive evaluation (NDE) is a widely used method of quality assurance and structural integrity in the manufacturing industry. Using laser ultrasonics rather than transducer-based ultrasound enables a non-contact inspection which is ideal for in-process inspection in the manufacturing industry, since the manufacturing process radiates high temperatures. Laser ultrasound can also cope with the complexity of the components among other advantages.

Hilde Metzger (she/her) - Clarity for the Cavity: A Framework for Acoustic Cavitation Measurement and Reporting

Cavitation (ultrasonically driven bubble activity) has a variety of applications in the medical and industrial sectors. However, there is currently no framework for the measurement and reporting of cavitation which means that the scientific literature is inconsistent, and it is difficult to compare studies from different groups. Current issues include metrics, such as the mechanical index, that are being used beyond their limitations and a lack of a proper classification system means that cavitation is often categorised as either stable or inertial with little scientific reasoning.

The aim of my project is to develop a scientifically grounded framework that will tackle these issues and will allow for meaningful comparison between similar studies over a range of medical and industrial applications. To do this, I will study many types of cavitation in experiments that are representative of the applications. High-speed imaging with parallel acoustic monitoring will help determine a fundamental understanding of the acoustic cavitation signal, which will allow for the critical analysis of current practices and propose new ones.

In partnership with Precision Acoustics Ltd, I hope to share my findings with the British Standards Institute (BSI) committee on ultrasonics and contribute to international standards that will ensure more consistency in cavitation research.

Dennis Abraham (he/him) - Novel transducers for gas coupled applications with prospects for flow measurement

I'm Dennis Abraham, a graduate from the University of Glasgow with a BSc Aeronautical engineering, pleased to join the unique Fuse CDT programme, and excited to learn and work alongside the brightest academics to push boundaries in the field of ultrasonics for the future. Firstly, I was drawn to the Fuse CDT programme as it included a taught year so that I am well equipped with all necessary learning to complete my PhD, in addition the opportunity to work alongside a cohort of researchers from a diverse range of disciplines is a chance I cannot miss. Lastly, I am thrilled to have the chance to work alongside the top academics, and leading industrial partners and is among the top universities in the U.K. I am sure that the Fuse CDT programme is a highly valuable opportunity that will greatly aid me to develop strong working relationships with my fellow researchers, academics, and industrial partners. Further, I am hopeful and confident that my time at Fuse and the PhD experience will allow me to push boundaries in the fields of Non-destructive testing and medical imaging in Ultrasound. These fields have unlimited research areas that still need to be explored and further, it is essential to carry out research in these areas and a benchmark for further advancement in the field of Ultrasound. Finally, I would like to conclude by saying I am certain that the Fuse CDT programme is a valuable opportunity that will help me to build strong working relationships and further lead me to develop both professionally and personally.

Posters

Vedran Tunukovic (he/him) - Integrated ultrasonic sensors for the in-situ stent, graft, or stent-graft patency monitoring

My name is Vedran and I am a PhD student in the FUSE CDT program. In 2019 I completed my master's degree at the University of Zagreb in Power and Process Engineering. To reflect my passion for music and sound, I also pursued a degree in Audio Engineering and Production. Following my work as an engineer, I took the opportunity to move to Scotland and start my academic journey on a new and challenging topic. I am interested in the FUSE CDT program because it offers great opportunities for education, personal development, and networking.

My potential areas of interest for a PhD project are, but are not limited to, medical ultrasound, therapeutic ultrasound, medicine delivery technologies, ultrasound in cancer research and early discovery. When I am not busy with my studies, you will probably find me exploring Scotland, enjoying music or grabbing a nice cup of coffee near the botanical gardens with my family.

Rachel Stoakes (she/her) - LIPUS for Soft Tissue Healing

I am an MEng Biomedical Engineering graduate from the University of Glasgow with a keen interest in the use of ultrasonic techniques within a medical field, particularly within surgical procedures and investigating how tissues respond to ultrasound. During my Masters project, I also gained experience in biomaterial formulation and mechanical testing. I am therefore eager to study the materials involved in ultrasonic surgery and how these can be optimised. I am hoping to find a project that combines these interests with the aim of combating challenges such as the improvement of postoperative outcomes for patients and providing ease of use for surgeons through potential 'smart' materials.

As a first-generation student, I am looking forward to the opportunities that FUSE has to offer, especially the outreach projects that encourage more young people to study STEM subjects. I am very excited to have the opportunity to work with and learn from a variety of people involved in FUSE so that I can successfully develop as a researcher in the field of Ultrasonic Engineering.

Saja Al Ani (she/her) - The Potential for Neural Networks to be Implemented with FPGAs for Veterinary Ultrasound

I'm Saja Al Ani, a first-year PhD student in ultrasonic engineering at the EPSRC Centre for Doctoral Training in Future Ultrasonic Engineering (FUSE CDT). I have completed a Bachelor of Science in Information Technology, followed by an MSc. degree in E-learning Technology from the University of Hertfordshire. I have wide-ranging experience through my previous roles as an IT administrator, customer advisor, as well as computer and gaming analyst.

Joining the FUSE CDT program is a highly valuable opportunity that will greatly help me to develop and expand strong knowledge and experience in ultrasonic engineering. In addition, this comprehensive programme will enable me to learn about the latest technological developments in the field of ultrasonics and their impact on various applications. I'm particularly interested in the medical applications of ultrasound, and how artificial intelligence has enhanced the development of this field. The impact of these technologies can be tremendous, as they can enhance the productivity of the healthcare practitioners to diagnose and treat diseases, improve the efficiency of the healthcare system, and provide better quality care to more patients.

Adam Getty (he/him) - Signal Processing in Ultrasonic Flow Meters: Algorithms and Complexities

I am an Electronic and Electrical Engineering graduate from the University of Strathclyde, holding a BEng (Hons). I became interested in the applications of Ultrasonics during my final year project. My project focused on signal processing techniques to extract transfer functions between source and sensors in the underwater environment, work that could begin to involve SONAR technologies. This led to my discovery of FUSE and the great work the CDT is involved in.

With my time at FUSE underway, I am developing interests in the applications of signal processing to aid in the analysis of ultrasonic systems. This covers a broad range of applications, so my mind is open to all avenues that resonate and spark some thought.

I could take all day describing where my interests are growing. The diversity among projects is vast and with each day new questions arise. On that note, FUSE is an incredibly exciting place to be and my current interests in signal processing, transducer technologies and cavitation are aplenty and growing!

Table Discussions & Poster Presentation 2

Ben Jacobson (he/him) - Optimising Acoustic Cavitation Mediated Decontamination of Surgical Instrumentation

In the UK alone, over 4.7 million surgical procedures are performed each year. Each surgery requires the use of around 20 individual surgical instruments. These instruments are often expensive and complex, hence are reusable. It follows that each instrument must be decontaminated between procedures. Decontamination requires each instrument to be completely cleaned of foreign material with subsequent disinfection and sterilisation. The cleaning stage is critical in avoiding patient exposure to infections carried on dirty instruments.

A principal tool in surgical instrument decontamination is ultrasonic cleaning. In this process Instruments are submerged in a liquid and energy is delivered to the surfaces of the instrument in the form of ultrasonic waves that create cavitation bubbles within the liquid volume. When these bubbles collapse, shockwaves are generated that remove contamination from adjacent surfaces. In partnership with Aseptium, this project will investigate several perspectives of ultrasonic cleaning of complex surgical instruments in order to better understand the precise mechanisms by which bubbles clean, leading into further optimising the cleaning process to deliver the best decontamination procedure possible. Both state-of-the-art high-speed cameras and novel in-house acoustic detection devices will be utilised for imaging rapid acoustic cavitation bubble dynamics & interaction with the instrumentation, and monitoring & mapping of the acoustic signal, respectively.

Abdul Hadi Chibli (he/him)- Combined Ultrasound Sensing and Therapeutic Tools for Robotic Surgery

I am a PhD student in the Future Ultrasonic Engineering (FUSE) CDT working on ultrasonic cutting and hybrid ultrasonic cutting/imaging tools for robotic surgery. Recently, robot-assisted surgical platforms such as the Da Vinci robot have been increasingly applied through every aspect of surgery, replacing both open and laparoscopic surgeries due to its significant improvements in visibility and manipulation.

There are many areas to be explored when considering how to improve on the existing technology in this area. Here I will focus on developing an ultrasonic tool. Ultrasonic dissection, resection, and cauterization tools like the Harmonic Ace (Ethicon) which are compatible with Da Vinci assisted robot have proven to be better than conventional tools in terms of minimising blood loss. Equally, ultrasonic imaging systems have been proven to be safer than alternative methods because it does not expose the body to radiation like CT systems, as well as working more effectively in real time and having a smaller profile compared with MRI systems. For this reason, my PhD will focus in developing Combined Ultrasound Sensing and Dissection Tools for robot-assisted surgery. I am excited to move forward in this research.

Lyne Mkoh (she/her)- Calibration and Modelling of Hyper-elastic Materials

As a current PHD student in the Future Ultrasonic Engineering (FUSE) CDT, my research theme, in collaboration with the NHS, is to explore a re-engineered transbronchial biopsy needle to improve sample tissue yield.

In medicine, especially in cancer medicine, biopsy procedures are of critical importance as they allow tissue sampling by insertion of a hollow needle for use in various medical tests. One type of needle biopsy currently in use is Endobronchial Ultrasound Guided Transbronchial Needle Aspiration (EBUS-TBNA) which is used to sample lymph node tissue to stage cancers and diagnose granulomatous diseases. During the EBUS-TBNA procedure, a tubular medical imaging tool (a bronchoscope) is inserted through the patient's mouth into the bronchial tree. Once the right location in the bronchial tree is found using the attached ultrasound system, a needle pierces through the bronchial wall into the lymph node to collect the tissue sample. Several medical institutions around the world have found that the procedure suffers from a sub-diagnostic ability as the devices currently in use push the tissue away rather than allowing it to enter the needle due to the needle tip shape. Because of this, the diagnostic yield is characterised to be of required quality if the collected tissue sample is estimated to be 61%. A failed diagnostic procedure slows down treatment and causes additional strain on patients and hospital infrastructure.

The aim of my PHD project therefore will be to design a better needle. This will be achieved by understanding the properties of the tissue and its interaction with the needle. To achieve this, several areas will be looked at:

- The needle types, tissue type and insertion speed.
- The behaviour of tip of the needle during the puncture of a membrane involving cadavers and critical specimens will be explored.
- A model describing the interaction between the different aspects of a needle-tissue interaction. This model is particularly important as it will enable the detailed encoding of experimental equipment, conditions, designs and results and can therefore be used as the blueprint for a database of experimental needle interaction with human tissue.

I am excited to move forward in this research and I hope my findings will contribute to better medical practice at an international level.

Olubunmi Onanuga (she/her) - Determination of the Elastic Piezoelectric and Dielectric Properties of the Lead-free Pz12 Piezoceramic'

In ultrasonic devices, the piezoelectric material is the principal source of ultrasound. In ultrasonic devices used in therapeutic and surgical applications, the most commonly used piezoelectric material is lead zirconate titanate (PZT), a lead-based piezoelectric ceramic. However, due to the adverse effect of lead on human health and the environment, as well as the health and safety legislation relating to its use in electronic and medical devices, there is an increasing demand for lead-free piezoelectric materials.

The performance of power ultrasonic devices is reliant on the elastic, piezoelectric and dielectric (EPD) constants of the piezoelectric material adopted in the design process. Also, the EPD matrices, populated by these constants, are vital inputs for finite element modelling used in the design of devices. Hence, it is essential to obtain the full elastic, piezoelectric and dielectric constants of new lead-free piezoelectric materials in order to evaluate their properties for use in power ultrasonic devices for therapy and surgery.

The overall aim of my PhD project, a collaboration between FUSE CDT and Meggitt A/S, is to propose novel power ultrasonic device designs by combining finite element analysis with the full characterisation of newly developed lead-free piezoelectric materials. To achieve this aim, a method which combines conventional characterisation techniques with a finite element model optimisation algorithm will be used to obtain the EPD constants for a range of lead-free materials. The research will investigate how these properties of the lead-free materials can be optimally employed in power ultrasonic devices through proposing novel transducer configurations.

Posters

Agnese Ola (she/her) - Development of Artificial Intelligence tools for therapeutic ultrasound

I'm Agnes. My background is in software development and IT, specifically in marine IT systems. After putting my seafaring days behind me, I graduated from the University of Glasgow with a BEng in Electronic and Software Engineering in 2021.

I am now a PhD student with FUSE CDT. I am looking forward to learning more about ultrasound technology and combining it with my experience with computer systems.

My PhD project is in AI and computer vision related to pre-symptomatic ultrasound cancer therapy. I will be working on creating AI tools for thermal mapping of the effects of high-intensity focused ultrasound under the supervision of Dr Kevin Worrall.

Andrea Orthodoxou (she/her) - LIPUS and its biological effects for bone healing

Hello, I am Andrea Orthodoxou, and I am in the first year of the FUSE CDT program as a postgraduate researcher. I graduated from the University of Glasgow in 2021 with an MEng in Biomedical Engineering. During my time as an undergraduate, I have had the chance to expand my knowledge and interest in ultrasonics. It is fascinating how the oldest imaging modality can be used for so many different applications in so many different fields.

Joining FUSE CDT for my postgraduate research makes me confident that I will be prepared to undertake a project by giving me the opportunity to get extensive knowledge of ultrasonics and hence choose the right project for me. I am really looking forward to starting my own research and contribution to science by finding innovative solutions to existing problems.

Luke Prentice (they/them) - Wearable Ultrasound Sensors for Sonomyography in Robotic Prosthesis and Augmentation

I graduated from the University of Strathclyde in 2021 with a BEng in EEE after having focused predominantly on embedded systems, radar system design and signal processing. I took interest in FUSE as I thought my foundational knowledge that I gained from designing radar would serve me well in ultrasonics and after looking through the work being done by the other members I could not wait to be a part of it.

I have not yet decided on a research project but I am taking an early interest in the use of neural networks to improve imaging techniques, sonar systems and sonomyography.

Aasim Mohamed (he/him) - Deep learning for ultrasonic and laser ultrasonics

My name is Aasim Mohamed, I hold a BSc (Hons) in Mechatronics Engineering from the Future University in the Republic of Sudan. I have two years industrial experience as a maintenance engineer within the steel fabrication industry in the Middle East region working with automated equipment, sensors, and instrumentation devices. After that, I pursued an MSc in Mechatronics Engineering at De Montfort University in Leicester.

It is a valuable opportunity for me to be part of FUSE CDT, the largest academic ultrasonic engineering unit in the world, to contribute to helping tackle the existing challenges, and adopting ultrasound applications and methods in new areas within the industry, ultrasound medical diagnostic and treatment applications. I hope to grow under the supervision of the world-leading academics in the field with the support of our industrial partners, as well as my fellow researchers

The manufacturing process, robotics, and ultrasound medical devices are facing a new era with the expanding field of ultrasound technology that takes measurement devices to a new level. The automation of non-destructive testing imaging methods and power ultrasonic applications will play a significant role in the industry regarding time, cost, operational safety and in-process monitoring.

'Life Beyond the PhD' Discussion Panel

This will be an interactive Q&A session to learn more about life beyond the PhD.

Chaired by: Prof Margaret Lucas.

Dr Holly Lay (she/her)

Holly S. Lay received her B.Sc. degree in electrical engineering and Ph.D. degree in engineering physics from Queen's University, Kingston, ON, Canada. After working in industry for two years at Sonovation Inc, she joined the Sonopill Programme at the University of Dundee and University of Glasgow as a Postdoctoral researcher. After that, she moved to Toronto, Canada to take a position as a Senior Ultrasound Systems Developer at FUJIFILM Visualsonics Inc. She now works as VP Transducers and Acoustics at Acoustic Inc in Bellevue, Washington, USA. Her work has focused on ultrasound device development and integration for a variety of applications, including biometrics, surgical robotics and diagnostic and therapeutic medical ultrasound.

Dr Nico Fenu (he/him)

Dr Fenu received a BEng in Biomedical Engineering from the University of Cagliari, Italy, in 2015, and in 2017 received an MSc (Hons) in Biomedical Engineering from the University of Dundee. Dr Fenu completed his PhD at the University of Glasgow on 'Investigation of piezoelectric materials for ultrasonic surgery' which focused on doped piezocrystals and lead-free piezoceramics for high-power, low-frequency ultrasonic applications. During the final year of his PhD, Dr Fenu joined the programme grant 'Ultrasurge' where he worked on miniaturised ultrasonic surgical tools for integration with robotics. In 2021 Dr Fenu founded a spin-out company from the University of Glasgow called Nami Surgical. Dr Fenu leads Nami's R&D activities and serve as interim CEO.

Dr Theodosia Stratoudaki (she/her)

Dr Stratoudaki is a Senior Lecturer at the Department of Electronic & Electrical Engineering, which she joined in 2017 as a Strathclyde Chancellor's Fellow. She obtained her PhD in laser ultrasonics for carbon fibre composites from the Physics Department at the University of Warwick. After a year of post-doctoral work at the Department of Chemistry of Cambridge University, she joined the Applied Optics Group of the University of Nottingham, before joining Strathclyde.

Dr Steffan Gwyn (he/him)

Steffan successfully defended his PhD thesis, entitled 'GaN-based distributed feedback laser diodes and their applications' in September 2021, as a student in the CDT for Photonic Integration and Advanced Data Storage. From March 2021, Steffan was employed as an External Engagement Officer in the School of Physics and Astronomy at the University of Glasgow, before moving to a more centralised role in the College of Science and Engineering as a Research Development Officer and IAA Knowledge Exchange Associate.

Steffan supports academics at the University of Glasgow with developing fellowships, proposals, and collaborations. Additionally, he is currently leading on the development of the Space theme within the University, through the Space Glasgow network. This brings together academics across the University whose research is applicable to space, helping develop strategic collaborations with key stakeholders in the Space industry, to enhance the University's presence in this area.

External Partner & Outreach Team Exhibit

The annual scientific meeting's sponsoring partners will exhibit some of their research in the networking area alongside the FUSE CDT Outreach team. You can also use this as an opportunity to network with others.

Canon – Mrs Klaudia Jung (she/her)

Canon Medical Research Europe is a leading medical software research and development centre of excellence, generating breakthrough technologies and valuable intellectual property for Canon Medical Systems. Based in the diverse city of Edinburgh we employ over 100 people working as Software Engineers, Scientists, Clinical Specialists, Testers and Business Support and are part of a global corporation headquartered in Japan. We develop next-generation medical imaging software to integrate with Canon Medical scanners and other diagnostic healthcare solutions which are installed in hospitals and healthcare centres across the globe.

Novosound – Dr Claire Thring (she/her)

Novosound is an award-winning Scottish tech company that was founded by Dr Dave Hughes in 2018, the first spin-out company to emerge from the University of the West of Scotland and has rapidly grown to become a global business. Novosound specialises in the design and manufacture of innovative ultrasound sensors using a groundbreaking thin-film technique to address the limitations of traditional ultrasound. This includes NDT products and customisable solutions for emerging applications in industrial, medical and wearable markets. The underlying technology from Novosound is developed in-house at our facility in Scotland, utilising a thin-film manufacturing process to make ultrasound sensors from a flexible core material rather than from conventional rigid materials, produces high resolution and can operate at extremely high temperatures.

Thales - Dr Laura Stoica (she/her)

Thales is a team of over 6,500 experts, including 4,500 highly skilled engineers, across nine key UK sites. They have unrivalled experience across every major industry they serve - working around the clock to make life better and to keep us safer. They're a global technology business operating across aerospace, defence, digital security, transport, and space.

CeramTec – Mr Liam Dillon (he/him)

CeramTec is a leading developer and globally active manufacturer and supplier of special solutions made of advanced ceramics with more than 3,400 employees. Our solutions are used worldwide in automotive and mechanical engineering, medical technology, electronics, aerospace technology and energy and environmental technology.

Verasonics – Dr Jack Potter (he/him)

Verasonics, Inc. is dedicated to assisting scientific investigators and innovators advance research and development in all applications of ultrasound. With unparalleled quality, versatility and efficiency, the Verasonics' Vantage™ system is the leading enabler of research ultrasound. Vantage systems utilize state-of-the-art hardware and software technologies giving researchers access to raw ultrasound data from each channel in real-time while preserving the ability to perform high-quality real-time imaging at clinically useful frame rates. Whether it is the integration of a custom transducer array, development of novel beamforming techniques, or creation of new image processing algorithms, Vantage is the ideal solution to meet and exceed research and development requirements.

Outreach Team

The outreach team have recently had their first exhibit at the Glasgow Science Festival and is keen to show what activities they have developed to teach children and adults about their research and how ultrasound is used in their everyday lives.

EPSRC Up-date

We will have an up-date on EPSRC strategy and CDTs from Will Gompertz, Portfolio Manager, EPSRC.

The Engineering and Physical Sciences Research Council (EPSRC) is the main funding body for engineering and physical sciences research in the UK. They invest in a range of fields from healthcare technologies to structural engineering, manufacturing, mathematics, advanced materials and chemistry. The research they fund provides a platform for future UK prosperity by contributing to a healthy, connected, resilient, productive nation.

Academic Presentations 2

Dr Ehsan Mohseni (he/him) - In-process non-destructive evaluation of additive manufacturing

Ehsan Mohseni is a Lecturer at the Centre for Ultrasonic Engineering (CUE), at the University of Strathclyde. He has been co-developing agile and flexible automated acoustic and electromagnetic-based robotic NDE solutions for welding, joining, and additive manufacturing. He currently supports the Royal Academy of Engineering and Spirit AeroSystems Research Chair, Professor Gareth Pierce, in his endeavours of delivering automated NDE solutions for the inspection of composites and additive manufactured products in the aerospace sector. His current research is aligned with the NDE 4.0 vision and objectives to identify and tackle future NDE technology barriers in Industry 4.0. His research interest encompasses different NDE domains where electromagnetic and acoustic wave propagation principles play key roles in various automated inspection scenarios.

Dr Koko Lam – Miniature intravascular dual-modality catheter with coaxial excitation and detection

Koko Lam received the M.Phil. and Ph.D. degrees in Applied Physics from The Hong Kong Polytechnic University (HKPolyU), Hong Kong. He was a Research Associate with the National Institutes of Health Resource Center on Medical Ultrasonic Transducer Technology, Department of Biomedical Engineering, University of Southern California, Los Angeles, CA, USA. He started his academic career as an Assistant Professor and then promoted to Associate Professor & Associate Head in Department of Electrical Engineering at HKPolyU.

Koko Lam has been working in the field of energy-related materials and applications including materials for energy conversion (e.g., piezoelectrics, thermoelectrics, etc.) and storage (e.g., electrode materials for rechargeable batteries, dielectrics, etc.), ultrasound transducer technology for biomedical and non-destructive evaluation applications, and smart sensor and actuator technology. He has achieved 210+ publications, including 7 patents for 6 inventions, 180+ SCI journal papers, and 20 international conference papers. He was a recipient of the Early Career Award from the Research Grants Council of Hong Kong in 2014.

Keynote Speaker

Prof. Lorena Pardo - 'Progress in the characterization of piezoelectric ceramics from electromechanical resonance'

She studied (1977-1982) and got her degree in Physics at the School of Physics of the Universidad Complutense de Madrid. She joined the Department of Ferroelectric Materials, Institute of Materials Physics of the Spanish Consejo Superior de Investigaciones Científicas (CSIC) in 1982. She was visiting graduate student at the Materials Research Laboratory, Pennsylvania State University, State College, PA, USA (1984-1985). She got her PhD degree in Physics from the Universidad Complutense de Madrid in 1987 with her work at CSIC and become a Staff Member of CSIC in 1989. She is Research Professor at the Madrid Materials Science Institute (ICMM-CSIC) since 2008. She has authored or co-authored some 220 publications in the field of polycrystalline ferroelectric materials, processing, and multifunctionality.

She was the Spanish Leader in several projects of the European Commission (EC) in collaboration with European industries, universities and research laboratories on ferro-piezoelectric ceramics and, also, as thick films and UV-assisted processing of thin films. She was involved in managing and scientific tasks in EU Networks (COST514 and 528, POLECER, MIND_NoE, CSA_PI). She contributed to establishing the European Institute of Piezoelectric Materials and Devices (Piezoinstitute) in 2008. She was involved in the series of Conferences on Piezoelectrics for End Users since its origin (Interlaken, Switzerland, 2002) and Chair of the PIEZO2017 Conference in Cercedilla (Madrid). She became Chair of its Advisory Board (2019-2021) and at present, she is Vicepresident of The Piezoinstitute (2021-).

External Partner Presentation 2

Novosound

Dr Claire Thring

Novosound is an award-winning Scottish tech company that was founded by Dr Dave Hughes in 2018, the first spin-out company to emerge from the University of the West of Scotland and has rapidly grown to become a global business. Novosound specialises in the design and manufacture of innovative ultrasound sensors using a groundbreaking thin-film technique to address the limitations of traditional ultrasound. This includes NDT products and customisable solutions for emerging applications in industrial, medical, and wearable markets. The underlying technology from Novosound is developed in-house at our facility in Scotland, utilising a thin-film manufacturing process to make ultrasound sensors from a flexible core material rather than from conventional rigid materials, produces high resolution and can operate at extreme high temperatures.

Table Discussions & Poster Presentations 3

Alistair Lawley (he/him) - Automation for Patient Screening

Ultrasound is one of the most accessible and highly used clinical diagnostic modalities currently available on the market today but much of its potential still remains untapped. This project focuses on getting the most out of ultrasound using advanced AI techniques to future-proof ultrasound as a tool for the clinicians of tomorrow.

This collaboration between Canon and FUSE CDT aims to investigate image-based solutions to diagnostic, automation, and workflow problems. Alistair will work closely from within the industry partner to achieve the intended goals with many exciting potential avenues to build upon as the collaboration progresses.

Being deeply embedded into the host company the student is able to quickly react to the needs of the project. For Alistair, the opportunity to build upon existing skills while working with a highly regarded Industrial partner was too good to pass up. This project could potentially include machine learning/AI, computer vision, and automation - all of which are highly in demand across scientific and industrial fields. Medical ultrasound allows for highly accurate real-time medical imaging without the use of ionizing radiation leading to many potential uses in patient screening.

Ultrasound screening techniques are currently a hot topic of research with many potential clinical uses in the future. Having a student with clinical expertise backed up not only by the professional experience already within the host industrial sponsor but also within FUSE CDT itself has the potential to take advantage of these techniques as they are identified.

Mohamed Abdalla (he/ him) - Ultralow-power, Millimetre-sized Integrated Electronics for Acoustic Sensors

I graduated in July 2015 from the Queen Mary University of London with an MEng in Electronic Engineering. I am a graduate with experience in analysing, solving and designing electronic circuits and programming. My MEng projects focussed on antenna design and simulation. My particular interest in this program is in real scientific research experience directed to the practical solution of problems in the field of engineering. This is what I would like to pursue in my professional life in the future.

Jayden Tomkinson (they/them) - Towards autonomous surgery: Investigation of Autonomous Multiple Manipulator Ultrasound Scanning

During surgery with ultrasound imaging, the ultrasound probe can be placed in a less than ideal position leading to suboptimal images for the surgeon to use. Usually, in minimally invasive surgery the imaging system is controlled by the least experienced member of the operating team leading to more difficult images for the surgeon to use as guidance. It is often difficult to find a suitable acoustic window to the image while operating or treating noninvasively using ultrasound, and this challenge is compounded by the need to provide good acoustic coupling between transducers and the body. My project looks towards a system that can autonomously scan, collect, and display clear real-time ultrasound images of the region of interest.

My initial research is into creating a simulation of the robot manipulator and focusing on the workflow and key parameters needed to successfully simulate an ultrasound probe. This would include the limitations of robotic manipulators movement and force applied to the skin. The main aim of this project is to support surgery with real-time ultrasound imaging.

Dion Blackburn (he/him) - Ultrasonic Evaluation of Additively Manufactured Titanium Components

My name is Dion Blackburn, and I am currently in my first year as a FUSE PhD student. I graduated from the University of the West of Scotland in 2019 with a BSc (Hons) in Physics where my honours project was on the "Numerical analysis of complex-valued resonances in piecewise-defined one-dimensional quantum potentials". After which I continued my studies at the University of Glasgow and obtained an MSc in Theoretical Physics with my MSc project being on the "Calculation of modes on the surface of polyhedra through the use of properties inherent in Bessel modes". I am looking forward to learning about the latest developments in the world of ultrasound and with the breadth that this field encompasses I am keeping an open mind with the possible projects.

Posters

Priyanka Dhiwa (she/her) - A study of metamaterials applied to biomedical ultrasound

I'm Priyanka Dhiwa, a graduate of Amity University India with a Bachelors and Masters of Technology degree (Distinction) in Nanoscience and Nanotechnology. Following a year internship at National Physical Laboratory (NPL), India, my Masters project involves "Electrocaloric effect of ferroelectric polycrystalline ceramics for a solid-state Refrigerator". I'm currently in my first year of the FUSE CDT programme and am looking forward to expanding my previous knowledge and experience in ultrasonic engineering and learning about the latest technological developments in the field of ultrasonics. This helps me to develop strong working relationships with my fellow researchers, academics, and industrial partners.

With a lot to learn ahead of me, I am looking at all FUSE projects with an open mind but am particularly interested in medical field applications of ultrasound.

Zhijun Qian (she/her) - Additive Manufacturing in Transducer Design

I studied mechanical engineering during my Bachelors Degree. During those 4 years, I learned various aspects of mechanical engineering like solid mechanics, fluid dynamics, and so on. After my graduation, I went to work - first, as a project manager controlling a factory's product quality and process control. Later I worked as a mechanical engineer designing mechanical parts. Then, I started my Masters studies, focusing on non-destructive testing, especially in ultrasound technology. FUSE is a group of passionate people who are aimed at developing new technology to make the application of ultrasound really comes to people's daily life and thus change the world. That is inspiring and really attractive and I am quite fond of the creative environment of FUSE and the guidance from my professors as well, who is really helpful.

My areas of research interest include non-destructive testing, medical use, and new UT instrument design.

Dominik Duklas (he/him) - Ultrasound capsule endoscopy

I graduated with an MD diploma from the Medical University of Lublin, English Division, in 2016 and subsequently worked as a medical doctor, initially in Poland as an intern and then as a Foundation Trainee in Glasgow for NHS Greater Glasgow and Clyde. After a further year as a Clinical Fellow in Orthopaedics, I studied Biomedical Engineering at Strathclyde University, with my thesis being ultrasound-based. Currently, I'm working less part-time as a GP trainee and devoting the rest of my time to FUSE.

I became interested in FUSE as I wanted to combine both my medical and engineering backgrounds and always had a special interest in ultrasonics from the first time, I held an ultrasound transducer as a medical student.

My special interest areas are medical ultrasound including detection of pathologies, elastography and HIFU.

Yijia Hao (she/her) - AI-Driven Design of Analog Integrated Circuits for Ultrasound Imaging Systems

My name is Yijia Hao. I graduated from the Glasgow UESTC in 2021 with B.Eng. (Hons) in Electronics and Electrical Engineering with Information Engineering. My research interests include deep learning, attention mechanism and the application of machine learning in the field of ultrasound. I am eager to learn more about ultrasonic technology and its applications with FUSE CDT. With knowledge and skills in ultrasound, I hope to provide intelligent and valuable solutions to industrial applications.

Elmergue Germano (he/him)- Automated Inspection of Industrial Components Using Flexible Ultrasonic Transducer Designs

I achieved distinction in MSc Mechanical Engineering (Design) from Glasgow Caledonian University. I have a BEng (Hons) in Mechanical Engineering with thorough hands-on experience in design, manufacturing and testing within the space sector. By undertaking a successful 9-month work placement at Airbus Defence and Space in Germany, along with an Honours Project in partnership with the company, I developed both my technical and professional skills.

My aspirations lay in progressing my engineering career through the pursuit of specialist training and research at the PhD level in the field of Ultrasonic Engineering and achieving Chartership status with the IMechE. FUSE CDT is the first academic ultrasonic engineering programme worldwide which would provide me with an exciting opportunity to become a subject-matter expert in this field. Additionally, the programme linked their training to the Monitored Professional Development Scheme (MPDS), which will ensure opportunities, monitoring and feedback are available to allow me to apply for CEng. This is a gold standard of excellence across industry and academia and is highly valued by partners and clients.

Ultrasonics plays a fundamental part in a wide range of sectors including industrial and medical. I am highly interested in the non-destructive evaluation application due to its capabilities to detect defects including wrinkles and delamination in fibre reinforced polymer composite turbine blades using climbing robots.