PROGRAM BOOK

2017 First IEEE MTT-S International Microwave Bio Conference (IMBioC)

15-17 May, 2017

Gothenburg, Sweden

IEEE MTT-S CHALMERS UNIVERSITY OF TECHNOLOGY MedTech West

2017 First IEEE MTT-S International Microwave Bio Conference (IMBioC).

IEEE Catalog Number CFP17F43-ART

ISBN 978-1-5386-1713-7

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T10 Pegah Takook, Hana Trefna and Mikael Persson
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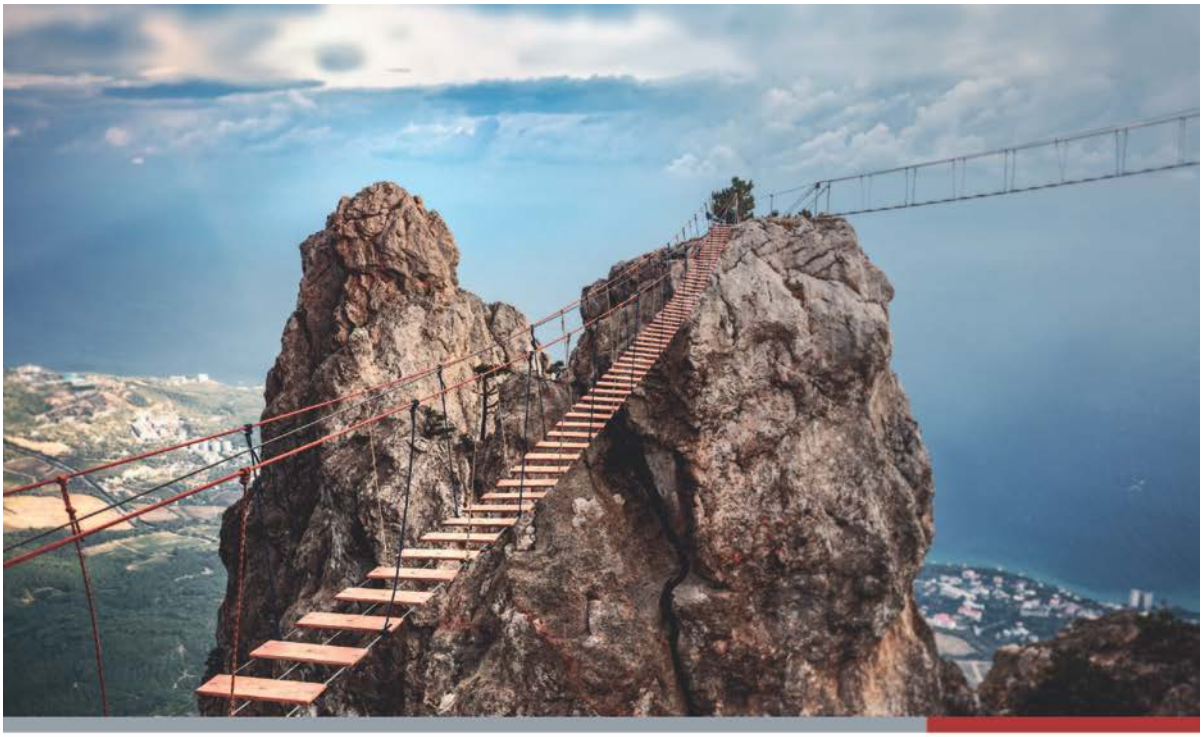
W8 Tomislav Markovic, Juncheng Bao, Ilja Ocket, Dries Kil, Luigi Brancato, Robert Puers and Bart Nauwelaers
“Uniplanar Microwave Heater for Digital Microfluidics”



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CHAIR´S MESSAGE

Dear Delegates,

On behalf of the Organizing Committee, it is truly a great pleasure for me to welcome you to the first IEEE MTT-S International Microwave Bio Conference on May 15th to 17th, 2017!

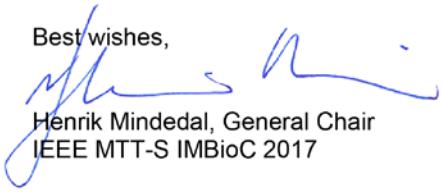
The use of microwave technologies for diagnosis, treatment, monitoring etc. of various diseases and conditions is an incredibly exciting area of research with huge potential. It is foreseeable that the impact on healthcare will grow explosively in the future. Within the next decade I expect to see numerous new applications, new start-ups, and new products that bring true value to patients, caregivers, and society worldwide. So, being part of this growing international community of researchers is the place to be!

Apart from speeches from our prominent keynote speakers, IEEE MTT-S IMBioC 2017 will include a series of paper presentations, a poster session and a Best Student Paper contest. We will also have the chance to get to know each other personally at our two social events, i.e. the reception on Monday evening and dinner on Tuesday evening.

Mid-May is one of the best times of the year to visit Gothenburg, and I am positive it will be a memorable one. The Organizing Committee appreciates your generous support and sincerely wishes you a very pleasant stay!

A warm welcome to IMBioC and Gothenburg!

Best wishes,



Henrik Mindedal, General Chair
IEEE MTT-S IMBioC 2017

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INSTRUCTIONS FOR SESSIONS

ORAL SESSIONS

Speakers are requested to be in the session room at least 10 minutes prior to the commencement of each session and report to their session chairs. The duration of the paper presentation is 20 minutes. This includes 15 minutes for the presentation itself and 5 minutes for questions from the audience. We appreciate it if all presenters can adhere strictly to this time limit.

Presentation slides must be prepared using Microsoft PowerPoint and should be brought to the conference on a memory stick. Presentation should be named: [session_code].[lastname]. For example: m5_fhager.

At the latest on the day of the presentation, the memory stick should be handed over to the person in charge of the presentations who will be available in the session room at least 30 minutes before the first presentation for that day is starting. For sessions that start after lunch, files should be handed over before leaving for lunch.

Presentations can not be handed over during the sessions.

Presentations for the next day can be handed over after that day´s sessions are over.

POSTER SESSIONS

For poster presentation, the dedicated area for your poster is marked with the poster session code, for example P1. Please attach your poster at least 10 minutes before the start of the session. Authors are requested to stay at their posters during the poster session. After the session, posters must be removed by the speaker him/herself. Any remaining posters will be removed when the conference is over. Left over posters will not be taken care of.

CONFERENCE DINNER

On Tuesday 16 May at 18.30 pm at Restaurant Cuckoo´s Nest at Radisson Blu Riverside Hotel a 3-course conference dinner is served. Pre-registration is mandatory.

http://cuckoosnest.se/en/about-us

GENERAL INFORMATION

WIFI

Network: Chsrab – C
Password: ChalmersKonferens

LANGUAGE

The local language is Swedish, but the conference is held in English.

VENUE

Lindholmen Conference Centre is a part of Chalmers Conference Centres. It is located along Lindholmen's waterfront. Find a map over the area here:
http://www.lindholmen.se/sites/default/files/content/PDF/lindholmenkarta_2013.pdf

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TRANSPORTATION TO AND FROM

Bike, car or bus, or even free ferry. There are many ways to get to Lindholmen. The ferry takes only 4 minutes from Järntorget and Bus 16 will take you to Lindholmen in 8 minutes from the Central Station. You will find maps and information on how to get to and from Lindholmen by bus, bike, ferry or car here:

http://www.lindholmen.se/en/area/getting-lindholmen

IMBIOC ONLINE

Mark your posts in social media with hashtag #imbioc2017.

The conference webpage: http://www.imbioc-ieee.org/

TIMETABLE MONDAY 15 MAY, 2017

12:40		Welcome
13:30 13.40	IN1	Session chair: Henrik Mindedal, MedTech West Keynote speaker 1: Professor Robert H. Caverly, Villanova University, Villanova, PA, USA "RF Aspects of Magnetic Resonance Imaging"
14:25	IN2	Keynote speaker 2: Professor Mikael Elam, Sahlgrenska Academy and Sahlgrenska University Hospital, Göteborg Sweden "Microwave-based Detection of Intracranial Hemorrhage"
15:10		Break 30 mins.
15:40	M1	Session 1: Microwave and RF Imaging Technologies (Focus session) Session chair: Robert Caverly, Villanova University Sessions 5 x 20 mins. Robert Caverly and Savannah Benbrook "Thermal modeling of Q-Spoil Switching Elements for MRI Coils"
16:00	M2	Jan Barowski, Ilona Rolfes and Christoph Baer "Real-Time Imaging System for Millimeter Wave Synthetic Aperture Radar Sensors"
16:20	M3	Juergen Sachs, Marko Helbig, Sebastian Ley, Bernd Faenger and Ingrid Hilger "Differential Microwave Imaging in Medicine based on Ultra-Wideband Pseudo-Noise MIMO-Radar"
16:40	M4	Vijayaraghavan Panda, Lance Delabarre, Thomas J Vaughan and Anand Gopinath "Metamaterial Line Element on a thin substrate for Magnetic Resonance Imaging RF Coils"
17:00	M5	Andreas Fhager and Mikael Persson "Reconstruction strategies for Microwave Imaging of breast; reconstructions constrained to the breast domain"
17:20		Reception and poster exhibition

POSTERS

P1 Larbi Benkhaoua, Smail Mouissat, Mohamed Taoufik Benhabiles and Mohamed Lahdi Riabi
"Miniaturized Planar Resonator for Bio-Sensing Field"

P2 Xiue Bao, Ilja Ocket, Dries Kil, Juncheng Bao, Robert Puers and Bart Nauwelaers
"Liquid Measurements at Microliter volumes using 1-Port Coplanar Interdigital Capacitor"

P3 Doojin Lee, Kangwook Kim and Robin Augustine
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P5 Daniel Laqua, Kurt Blau and Michael Naß
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P8 Hardik Patel and Deepak Ghodgaonkar
"3D Level Set Based Optimization of Inverse Scattering Problem for Microwave Breast Imaging"

TIMETABLE TUESDAY 16 MAY, 2017

08:40	T1	Session 2: Microwave Sensors for Bio/Chemical Sample Analysis Session chairs: Katia Grenier, LAAS-CNRS and Robin Augustine, Uppsala University Sessions 9 x 20 mins. Juncheng Bao, Tomislav Markovic, Ilja Ocket, Dries Kil, Luigi Brancato, Robert Puers and Bart Nauwelaers ”Investigation of Thermal Effect Caused by Different Input Power of Biosensor Using a Novel Microwave and Optical Sensing System for Biological Liquids”
09:00	T2	Anak Agung Alit Apriyana, Xiaojian Fu, Guangyin Feng, Guodong Su, Ling-Ling Sun and Hao Yu “A Label-free and Non-invasive CMOS Sub-THz Plasmonic Sensor for Circulating Tumor Cell Detection”
09:20	T3	Mario Müeh, Matthias Maasch, Michael Brecht, H. Ulrich Göringer and Christian Damm “Complex Dielectric Characterization of African Trypanosomes for Aptamer-based Terahertz Sensing Applications”
09:40	T4	Parul Mathur, Dhanesh G. Kurup and Robin Augustine “Design of Open Ended Circular Waveguide for Non-Invasive Monitoring of Cranial Healing in Pediatric Craniosynostosis”
10:00		Break 30 mins.
10:30	T5	Yassmina Yakhlef, Mohamed Taoufik Benhabiles, Larbi Benkhaoua and Mohamed Lahdi Riabi “Compact Miniature Sensors Based on Tapered Lines Coupled Metamaterial Resonators”
10:50	T6	Christian Schmidt, Maximilian Luebke, Marco Dietz, Robert Weigel, Dietmar Kissinger and Amelie Hagelauer “Determination of Changes in NaCl Concentration in Aqueos Solutions Using an M-Sequence Based Sensor System”
11:10	T7	Farabi Ibne Jamal, Subhajit Guha, Mohamed Hussein Eissa, Dietmar Kissinger and Jan Wessel ”A Low-Power 30 GHz Complex Dielectric Chem-Bio-Sensor in a SiGe BiCMOS Technology”
11:30	T8	Kateryna Arkhypova, Pavlo Krasov and Anatolii Fisun ”Millimeter-Wave Blood Cells Analysis: Another Outlook for Cellular Diagnostics”
11:50	T9	David Dubuc, Katia Grenier, Florent Morfoisse and Barbara Garmy-Susini “In vitro and in vivo investigations toward near-field microwave-based detection of melanoma”
12:10		Lunch 1 h.20 mins.
13:30 13:40	IN3	Session chair: Andreas Fhager, Chalmers University of Technology Keynote speaker 3: Professor Gerhard C. van Rhoon, Erasmus MC Cancer Institute, Rotterdam, Netherlands “Heating Tumors to Enhance Effectiveness of Radiotherapy and Chemotherapy”
14:25	IN4	Keynote speaker 4: Professor Paul M. Meaney, Dartmouth College, Hanover, NH, USA and Chalmers University of Technology, Göteborg, Sweden

		"Addressing multipath signal corruption in microwave tomography and the influence on system design and algorithm development"
15:10		Break 30 mins.
15:40	T10	Session 3: Microwave Hyperthermia Technologies (Focus session) Session chair: Hana Dobsicek Trefna, Chalmers University of Technology Sessions 6 x 20 mins. Pegah Takook, Hana Trefna and Mikael Persson "Performance evaluation of 2 hyperthermia applicators for deep-seated brain tumors"
16:00	T11	Carolin Reimann, Margarita Puentes, Holger Maune, Babak Bazrafshan, Frank Hübner, Thomas J. Vogl and Rolf Jakoby "A Cylindrical Shaped Theranostic Applicator for Percutaneous Microwave Ablation"
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17:00	T14	Gennaro G. Bellizzi, Lorenzo Crocco and Tommaso Isernia "SAR Constrained Focusing Through Multi-Frequency Array Applicators"
17:20	T15	Sönke Schmidt, Martin Schüßler, Zhen Luo, Rolf Jakoby, Henry Herce and Cristina Cardoso "Compact Dualmode Microwave Electroporation and Dielectrometry Tool"
17:50		Conference dinner (pre-registration is mandatory)

TIMETABLE WEDNESDAY 17 MAY, 2017

08:40	W1	Session 4: Radar and Imaging Applications Session chair: Christoph Baer, Ruhr-Universität Bochum Sessions 5 x 20 mins. Patrick Kwiatkowski, Timo Jaeschke, David Starke, Lukas Piotrowsky, Henrik Deis and Nils Pohl "A Concept Study for a Radar-Based Navigation Device With Sector Scan Antenna for Visually Impaired People"
09:00	W2	Christoph Will, Kilin Shi, Robert Weigel and Alexander Koelpin "Advanced Template Matching Algorithm for Instantaneous Heartbeat Detection using Continuous Wave Radar Systems"
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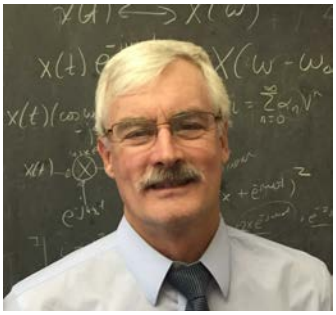
10:00	W5	Gregory Boverman, Cynthia Davis, Paul Meaney and Shireen Geimer "Image Registration for Microwave Tomography of the Breast Using Priors from Non-Simultaneous Previous Magnetic Resonance Images"
10:20		Break 30 mins.
10:50	W6	Session 5: Microwave Applications in Biological Tissues Session chair: Andreas Fhager, Chalmers University of Technology Sessions 3 x 20 mins. Noor Badariah Asan, Daniel Noreland, Syaiful Redzwan, Emadeldeen Hassan, Anders Rydberg, Thiemo Voigt and Robin Augustine "Human Fat Tissue: A Microwave Communication Channel"
11:10	W7	Birk Hattenhorst, Malte Mallach, Jan Barowski, Ilona Rolfes, Christoph Baer and Thomas Musch "Dielectric Phantom Materials for Broadband Biomedical Applications"
11:30	W8	Tomislav Markovic, Juncheng Bao, Ilja Ocket, Dries Kil, Luigi Brancato, Robert Puers and Bart Nauwelaers "Uniplanar Microwave Heater for Digital Microfluidics"
11:50		Closing of Conference
12:10		Lunch To Go

ABSTRACT KEYNOTE SPEAKER PROF ROBERT H. CAVERLY (IN1)



Speaker: Professor Robert H. Caverly. Villanova University, Villanova, PA USA

Topic: RF Aspects of Magnetic Resonance Imaging

Abstract

This presentation will focus on some of the RF aspects of the MR process and MR scanners. The MR image construction process and the control of the various steps that manipulate the atomic nuclei to generate the final MR diagnostic image put demanding constraints on RF equipment capabilities and these will be discussed, along with a high-level overview of the various components making up conventional MRI systems. This high-level overview will include a look at various examples of transmit and receive RF systems and examples of transmit and receive coils that make up MR scanners and system diagrams for both the RF transmit and receive paths. The talk will then narrow in scope to look at how these RF coils are modeled and controlled in both transmit and receive states and how these components are used for transmit/receive switching and patient and equipment protection. The talk will conclude with a look at current research that will eventually find its way into clinical and research scanners.

Biography

Dr. Robert H. Caverly received his Ph.D. degree in electrical engineering from The Johns Hopkins University, Baltimore, MD, in 1983. He has been a faculty member at Villanova University in the Department of Electrical and Computer Engineering since 1997 and is a Full Professor. Previously, he was a Professor for more than 14 years at the University of Massachusetts Dartmouth. Dr. Caverly's research interests are focused on the characterization of semiconductor devices such as PIN diodes and FETs in the microwave and RF control environment. He has published more than 100 journal and conference papers and is the author of the books Microwave and RF Semiconductor Control Device Modeling and CMOS RFIC Design Principles, both from Artech House. An IEEE Fellow, Dr. Caverly is an Associate Editor of the IEEE Microwave Magazine and serves on a number of MTT-S committees.

Dr. Robert H. Caverly´s webpage: http://rcaverly.ece.villanova.edu/rcaverly/rcaverly.htm

ABSTRACT KEYNOTE SPEAKER MD PROF MIKAEL ELAM (IN2)

Speaker: MD Prof Mikael Elam. Gothenburg University and the Sahlgrenska University Hospital. Göteborg, Sweden

Topic: Microwave-based detection of intracranial hemorrhage

Abstract

Stroke and traumatic brain injury are leading causes of death and severe disability and early, preferably pre-hospital, diagnosis is crucial to ensure adequate triage and treatment of these patients. In recent years, the ability of diagnostic systems based on microwave scattering measurements to detect intracranial hemorrhage has been investigated on phantom models and in several “proof-of-principle” clinical trials performed in stroke and trauma units at Sahlgrenska University Hospital. Results indicate a capacity to detect intracranial hemorrhage and to differentiate hemorrhagic *vs* ischemic stroke. Ongoing studies and device development aims at the introduction of a pre-hospital diagnostic system supporting early clinical decisions.

Biography

Mikael Elam MD PhD is professor/chairman of the Dept of Clinical Neurophysiology at Gothenburg University and the Sahlgrenska University Hospital. He is the author of >130 peer-reviewed original research publications, mainly in the field of autonomic neuroscience and neural control of cardiovascular function.

ABSTRACT KEYNOTE SPEAKER PROF GERARD C. VAN RHOON (IN3)

Speaker: Professor Gerard C. van Rhoon. Erasmus MC Cancer Institute, Rotterdam, Netherlands

Topic: Heating tumors to enhance effectiveness of radiotherapy and chemotherapy

Abstract

The use of heat to kill tumor cell goes back to ancient history with the first written reference found 3000BC in the Edwin Smith surgical papyrus. During the last decades the impressive benefits of adjuvant hyperthermia have been demonstrated in randomized trials, for locally advanced cervical cancer (doubling 3yrs overall survival (OS)), high risk soft tissue sarcoma (5yrs OS + 12%), nasopharyngeal cancer (3yrs +19% OS). The consistency of good results together with the observation that hyperthermia does not cause significant toxicity, demonstrate that hyperthermia is not just an anecdotal technology, but one that warrants continued investment and investigation.

As with other technology based treatments the ability to apply a well-controlled, high quality treatment is essential for good clinical outcome. During the last decades, several major technological innovations have been implemented to facilitate the application of a high quality hyperthermia treatment. The development and implementation of advanced Hyperthermia treatment planning as part of clinical routine, helps strongly in decision making i.e. can the tumor be heated adequately, a-priori selection of the optimal device settings per individual patient, as well as on-line optimization for patient specific complaints during treatment. High quality monitoring of the temperature distribution in tumor and normal

tissue during treatment remains a challenge, though non-invasive MR-Thermometry, especially when exploited to perform fast and patient specific, online calibration of temperature modeling, appears to be promising.

Currently the application of hyperthermia is experiencing a growing interest among Urologists for the treatment of non-muscle invasive bladder cancer and Surgeons for the treatment of peritoneal carcinomatosis of colorectal cancer using hyperthermic intraperitoneal chemotherapy. Supported by a growing understanding of the biological mechanisms of how heat sensitize tumor cells for radiotherapy and chemotherapy, the development of smart temperature controlled drug carriers and continuous innovation of hyperthermia technology will lead to increased use of hyperthermia for cancer treatment.

Biography

Gerard van Rhoon, is a Professor at the Erasmus MC Cancer Institute, department Radiation Oncology and director of the Hyperthermia unit. He is trained as a physicist and obtained in 1994 his Ph.D. at the Lab. of Electromagnetic Research, Faculty of Electrical Engineering, Mathematics and Computer Science, Delft University of Technology.

He started his career in 1977 within the department of Experimental Radiotherapy of the Erasmus University as researcher involved in the application of whole body hyperthermia. In 2011 he was appointment as Professor in Physical Aspects of Electromagnetic Fields & Health 2011 at the Erasmus MC Cancer Institute. Within the Erasmus MC Cancer Institute he is PI of the Academic Center of Excellence of Minimal Invasive Image Guided Therapy.

The research program focuses on development of electromagnetic technology for heating tumors with a specific aim at the improvement and assurance of the quality of the hyperthermia treatment. A strong focus of the research is on the assessment of critical parameters for the application of 3- dimensional treatment planning applied on-line during loco-regional deep and superficial heating including quantitative validation of treatment planning models. He has designed several high power RF measuring devices specifically for the measurement RF-fields in the near-field of RF-antennae.

A recent achievement was the development of a new hyperthermia system, for the first time in history completely designed through EM modeling to safely and adequately heat tumors in the head and neck region. This research is now commercialized via a start-up company. His recent interest is the development of technology to enable thermal-ablation brachytherapy to treat patients using minimally invasive, precise therapy as a one stop-shop intervention using high quality, intelligent and augmented reality imaging guidance.

He is the President of the European Society for Hyperthermic Oncology. Further, he is a senior editor of the Int. J. of Hyperthermia and auditor for Physics in Medicine and Biology. He is author of over 150 peer-reviewed publications and over 120 publications in books, proceedings and non-peer-reviewed journals. He is a frequently invited speaker at congresses on hyperthermia and bio-medical engineering. He has received the first Lund Science Award in 1987, the Dr. BB Singh Award and the ESHO-BSD award in 2008 and the Dr. Sugahara Award in 2012.

ABSTRACT KEYNOTE SPEAKER PROF PAUL M. MEANEY (IN4)

Speaker: Prof. Paul M. Meaney.
Dartmouth College, Hanover, NH, USA
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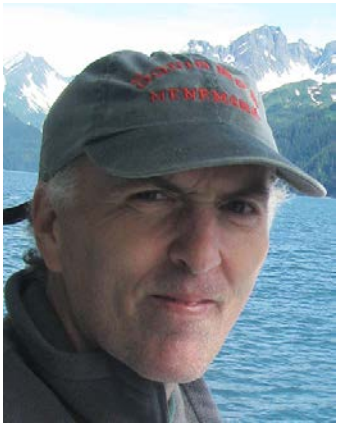

Topic: Addressing multipath signal corruption in microwave tomography and the influence on system design and algorithm development

Abstract

Multipath signals are a fact for any microwave system and can be remarkably debilitating, especially for near field systems. For long range communications and radar problems, their impact literally fades away. But for industrial and medical sensors and near field imaging devices, their influence is substantial and can be debilitating. The primary challenge with multipaths is that they are virtually indistinguishable from the desired signals. In all applications, measurement deviations from a calibrated value are usually interpreted as scattered fields from the device under test (DUT), from which the imaging information is derived. If left unchecked, the unwanted signals can dramatically disrupt and even completely overwhelm the desired ones and wreak havoc on the eventual image. In several recent examples, researchers who have dealt with this problem head-on have had meaningful success in translating imaging systems to the clinic. For near field systems, the most ubiquitous multipath examples are surface waves that can propagate along imaging chamber boundaries, feedlines and support structures. The ability for the waves to find efficient, low loss paths are well known. Systems deployed by these teams demonstrate an important appreciation of the nature of the impediments and strategies for reducing their effect. But, to a lesser appreciated degree, dealing with these challenges forces critical downstream decisions with regards to system design and algorithm development. For this, I focus on the challenges faced and overcome by the Dartmouth/Chalmers research teams in developing an effective microwave breast cancer imaging system.

While strategies exist to compensate for stray signal corruption such as time domain-based time gating approaches, our team chose to implement a lossy coupling bath to eliminate interfering fields. Even though the most immediate impact of this decision was the need for a higher dynamic range measurement device than is commonly commercially available, some of the more critical influences were in the development of the reconstruction algorithm. For this situation, a log transformed tomography approach is well suited because of the dramatic range of signal levels measured by the system. The log transform has a distinguished background and well-grounded provenance in other imaging modalities. It is widely used in various parameter estimation problems and especially for imaging including optical coherence tomography (OCT) and X-ray CT. In fact, for X-ray CT, the technique would essentially not be possible without it. For these applications, the transformation makes the image reconstruction process more linear. A similar claim can be made for its use in microwave tomography. The major challenge encountered in applying this technique to microwave tomography is that wavelengths are sufficiently small that phase wrapping becomes problematic which does not occur in either OCT or X-ray CT. But where this can be looked at as creating additional difficulties, we have drawn on experience from fields like MRI to show that this challenge provides new information and insight into the image formation process.

Biography

Dr. Paul Meaney received AB's in Electrical Engineering and Computer Science from Brown University in 1982. He earned his Masters Degree in Microwave Engineering from the University of Massachusetts in 1985 and worked in the millimeter-wave industry at companies including Millitech, Aerojet Electrosystems and Alpha Industries. He received his PhD from Dartmouth College in 1995 and spent two years as a postdoctoral fellow including one year at the Royal Marsden Hospital in Sutton, England. His research has focused mainly on microwave tomography which exploits the many facets of dielectric properties in tissue and other media. His principle interest over the last decade has been in the area of breast cancer imaging where his group was the first to translate an actual system into the clinic. His team has published several clinical studies in various settings including: (a) breast cancer diagnosis, (b)

breast cancer chemotherapy monitoring, (c) bone density imaging, and (d) temperature monitoring during thermal therapy. He has also explored various commercial spin-off concepts such as detecting explosive liquids and non-invasively testing whether a bottle of wine has gone bad. He has been a Professor at Dartmouth since 1997, a professor at Chalmers University of Technology, Gothenburg, Sweden since 2015, and is also President of Microwave Imaging System Technologies, Inc. which he co-founded with Dr. Keith Paulsen in 1995. Dr. Meaney holds 10 patents, has co-authored 70 peer-reviewed journal articles, co-written one textbook and presented numerous invited papers related to microwave imaging.

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