



**2022 IEEE International Microwave Biomedical Conference  
(IEEE IMBioC 2022)**

**Technical Program**

May 16-18, 2022

# IEEE IMBioC 2022 Program at A Glance

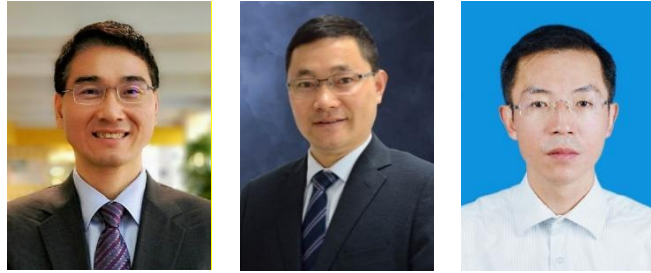
| May 16, 2022 (Mon)   |  |   |   |
|--|--|---|---|
| 8:40-9:00*   | Room 0   | Opening Ceremony  |   |
| 9:00-9:45  |  | MA0A-1 (Plenary 1): Advances in Antenna and Sensor Developments in Modern Medical Applications: Ergonomic MRI Neck Coils and Microwave Ablation Lung-Tuned Antennas, Prof. Yahya Rahmat-Samii |   |
| 9:45-10:30   |  | MA0A-2 (Plenary 2): Translational Research on Deep Brain Stimulation, Prof. Luming Li   |   |
| 10:30-10:40  |  | Break   |   |
| 10:40-11:25  |  | MA0B-1 (Plenary 3): Advances in Computational and Experimental Bioelectromagnetics for Healthcare: Sensors and Neurointerfaces, Prof. Gianluca Lazzi  |   |
| 11:25-12:10  |  | MA0B-2 (Plenary 4): Ultra-high field human whole-body 5.0 Tesla magnetic resonance imaging system and clinical trials, Prof. Hairong Zheng  |   |
| 12:10-13:30  | Lunch Break  |   |   |
|  | Room 1   | Room 2  | Room 3  |
| 13:30-15:30  | MP1A (SS): Recent Progress in Biomedical Radar   | MP2A (SS): Advanced Technologies for Microwave Medical Sensing and Wearable Devices   | MP3A (SS): Microwave Biomedical Imaging Methods and Systems   |
| 15:30-15:40  | Break  |   |   |
| 15:40-17:40  | MP1B (SS): Planar and Chip-Based RF & MW Devices for Liquid Biosample Analysis and Manipulation  | MP2B: WPT for Biomedical Applications   | MP3B (SS): Facing Challenges in Electromagnetic Dosimetry at Millimeter Waves and THz                     |
| May 17, 2022 (Tue)   |  |   |   |
| 8:30-12:00   | Room 0: TA-SPC: Student Paper Contest  |   |   |
| 8:30-10:15   | TA1A: Radar for Biomedical Applications  | TA2A (SS): WPT Schemes for Implantable and Wearable Sensors   | TA3A (SS): Research Highlights from Young Professionals in Microwaves in Biology and Medicine             |
| 10:15-10:25  | Break  |   |   |
| 10:25-12:10  | TA1B: Emerging Sensing Technologies for Biomedical Applications  | TA2B (SS): High Field or Low Field for MRI, What Do You Think?  | TA3B: Antennas for Biomedical Applications I  |
| 12:10-13:30  | Lunch Break  |   |   |
| 13:30-15:30  | TP1A (SS): Microwave Vibration Sensing and Its Applications on Biomedical Engineering  | TP2A: Tracking and Sensing Systems for Biomedical Applications  | TP3A (SS): Novel Methods and Algorithms for Electromagnetic Wave Induced Acoustic Biomedical Applications |
| 15:30-15:40  | Break  |   |   |
| 15:40-17:40  | TP1B: RF Sensing Technologies for Biomedical Applications I  | TP2B: Antennas for Biomedical Applications II   | TP3B: Microwave Biomedical Imaging  |
| May 18, 2022 (Wed)   |  |   |   |
| 8:30-10:00   | WA1A: Radar and Communications for Biomedical Applications   | WA2A: Body-Centric Communications and IoTs for Biomedical Applications  | WA3A: Wearable and Bio-Implantable Wireless Devices   |
| 10:00-10:10  | Break  |   |   |
| 10:10-10:40  | Closing & Award Ceremony   |   |   |
| 10:40-11:25  | WA0B-1 (Distinguished Lecture 1): Portable Radar Systems For Life Activity Sensing, Anomaly Detection, and Human Tracking, Prof. Changzhi Li |   |   |
| 11:25-12:10  | WA0B-2 (Distinguished Lecture 2): The History and Future of Implantable Antennas, Prof. Cynthia Furse  |   |   |
| 12:10-13:30  | Lunch Break  |   |   |
| 13:30-15:30  | WP1A: RF Sensing Technologies for Biomedical Applications II   | WP2A (SS): Sensing and Imaging based on Acoustics, Metamaterials and Metasurfaces   | WP3A: Antennas and Circuits   |
| 15:30-15:40  | Break  |   |   |
| 15:40-17:40  | WP1B (SS): Ultra Low-Power IoT Systems for Biomedical Applications   | WP2B (SS): Microwave-Induced Thermoacoustic Imaging and Its Basic Research of Medical Application   | WP3B (SS): Machine Learning in Biomedical Imaging Algorithms  |
| *All the times in the technical program are based on Beijing Time (GMT +8) |  |   |   |

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# Welcome Message from the General Chairs

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On behalf of the organizing committee, and with great pleasure, we warmly welcome you to the 2022 IEEE International Microwave Biomedical Conference (IEEE IMBioC 2022) to be held from May 16 to 18, 2022. The IEEE IMBioC 2022 was planned to be held in Suzhou and is currently delivered as a virtual event due to the Covid-19 pandemic. The organizing committee has put together a comprehensive technical program to facilitate exchanging ideas and information on state-of-the-art research in RF and microwave, antennas and electromagnetic theory and techniques, that bridge the science and engineering gap as applied to biomedical systems.

IEEE IMBioC 2022 is organized by National University of Singapore Suzhou Research Institute, co-organized by Nanjing University of Science and Technology. This conference is financially sponsored by IEEE Microwave Theory and Techniques Society (MTT-S). It is technically co-sponsored by the IEEE, IEEE MTT-S, IEEE Antennas and Propagation Society, and IEEE Engineering in Medicine & Biology Society. The purpose of this conference is to boost and promote MTT-S technical and educational activities as well as MTT-S international exchanges and collaborations. IEEE IMBioC 2022 brings in a unique mix of high-quality plenary, invited and contributed papers. In particular, we urge you not to miss our plenary talks and distinguished lectures, featuring innovative and enabling technologies on RF and microwave, antennas and electromagnetics for biomedical applications, by world-class speakers.

We look forward to welcoming you all to participate in this exciting virtual conference!

Yongxin Guo (General Chair), National University of Singapore, Singapore

Hairong Zheng (General Co-Chair), Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China

Wen Wu (General Co-Chair), Nanjing University of Science and Technology, China

# Welcome Message from the TPC Chairs

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On behalf of the Technical Program Committee (TPC), we cordially welcome you to the 2022 IEEE International Microwave Biomedical Conference (IMBioC 2022) to be held as a virtual event on May 16-18, 2022. The IMBioC 2022 received a total submission of 214 papers, including invited papers and regular papers from 25 countries/regions. Each paper was reviewed by at least two expert reviewers and the final decisions were made at the TPC online meeting held in March 2022. Among all the submissions, 31 invited papers and 136 regular papers were accepted. The TPC is very pleased with the quality of the submissions and we trust that you will find many papers interesting and informative.

All the accepted papers have been arranged into 27 oral technical sessions, including 14 special sessions and 13 regular sessions. The technical sessions will be split into three parallel tracks spanning over three days. Authors can choose either live presentation or playing pre-recorded presentation videos for the presentation mode. In addition, we are honored to have four renowned experts as Plenary Speakers and two renowned experts as Distinguished Lecturers. Another highlight is the Best Student Paper Awards for recognizing outstanding student papers. They were nominated by the TPC after considering the review reports and further carefully evaluated by the Award Committee.

The TPC has worked hard to produce a diverse and well-organized technical program, which covers nearly all topics on the recent advances of the state-of-the-art research in RF and microwave, antennas and electromagnetic theory and techniques for medical and biological applications. On behalf of the TPC, we would like to express our sincere thanks to all the authors for their contributions to the conference. We would like to express our sincere appreciation to all the TPC members, special session organizers, reviewers, session chairs, and those have been involved in finalizing this technical program. In particular, we would like to thank the IEEE MTT-S for its strong support to this conference.

We wish that we have brought you a pleasant and fruitful IMBioC 2022!

Changzhan Gu (TPC Chair), Shanghai Jiaotong University, China  
Roberto Gómez-García (TPC Co-Chair), University of Alcalá, Spain  
John Ho (TPC Co-Chair), National University of Singapore, Singapore  
Xiong Wang (TPC Co-Chair), ShanghaiTech University, China  
Jiang Zhu (TPC Co-Chair), Meta Platforms, USA

# Organizing Committee

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## **General Chair**

Yongxin Guo, National University of Singapore, Singapore

## **General Co-Chairs**

Hairong Zheng, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China  
Wen Wu, Nanjing University of Science and Technology, China

## **Technical Program Committee Chair**

Changzhan Gu, Shanghai Jiaotong University, China

## **Technical Program Committee Co-Chairs**

Roberto Gómez-García, University of Alcalá, Spain  
John Ho, National University of Singapore, Singapore  
Xiong Wang, ShanghaiTech University, China  
Jiang Zhu, Meta Platforms, USA

## **International Advisory Committee Co-Chairs:**

J. -C. Chiao, Southern Methodist University, USA  
Yang Hao, Queen Mary University of London, UK  
Koichi Ito, Chiba University, Japan  
Gianluca Lazzi, University of Southern California, USA

## **Awards Committee Co-Chairs:**

Xudong Chen, National University of Singapore, Singapore  
Changzhi Li, Texas Tech University, USA

## **Workshop/Special Session Co-Chairs:**

Shaoying Huang, Singapore University of Technology and Design, Singapore  
Yue Li, Tsinghua University, China

## **Young Professionals Co-Chairs:**

Emily Porter, University of Texas at Austin, USA  
Xiuzhu Ye, Beijing Institute of Technology, China

## **Publicity Co-Chairs**

Hong Hong, Nanjing University of Science and Technology, China  
Maxim Zhadobov, IETR/CNRS, France

## **Publication Co-Chairs:**

Bin Luo, Institute for Infocomm Research, Singapore  
Siping Gao, National University of Singapore, Singapore

## **Sponsorship Co-Chairs:**

Yuan Feng, National University of Singapore Suzhou Research Institute, China  
Hao Zhang, Northwestern Polytechnical University, China

## **Finance Chair:**

Faeyz Karim, Nanyang Technological University, Singapore

## **Local Arrangements Co-Chairs:**

Changrong Liu, Soochow University, China  
Jianpeng Wang, Nanjing University of Science and Technology, China

## **Conference Secretariat:**

Han Wang, Bo Wang, Haorui Luo  
National University of Singapore, Singapore

# Technical Program Committee Members

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Qammer H Abbasi  
Sasan Ahdi Rezaeieh  
Akram Alomainy  
Delia Arnaud-Cormos  
Maurizio Bozzi  
Greg Bridges  
Hung Cao  
Robert Caverly  
Haidong Chen  
Hui Chu  
Michal Cifra  
Sandra Costanzo  
Lorenzo Crocco  
Christian Damm  
Alessandro Fanti  
Aydin Farajidavar  
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Jing Jin  
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Asimina Kiourti  
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Cristiano Palego  
Zhengyu Peng  
Emily Porter  
Arnaud Pothier  
Marie-Pierre Rols  
Giulia Sacco  
Atif Shamim  
Jian Song  
Guanghao Sun  
Jianfei Sun  
Yifei Sun  
Thomas Ussmueller  
J Thomas Vaughan  
Jasmin Walk  
Baosheng Wang  
Fu-Kang Wang  
Guoan Wang  
Pingshan Wang  
Zhun Wei  
Chung-Tse Michael Wu  
Lin-Sheng Wu  
Zijun Xi  
Kuiwen Xu  
Yang Yang  
Chaofeng Ye  
Dexin Ye  
Xiuzhu Ye  
Maxim Zhadobov  
Lejia Zhang  
Eric Zhao  
Weiren Zhu  
Sasan Ahdi Rezaeieh  
Akram Alomainy  
Delia Arnaud-Cormos

# Session Information

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## Preparing Your Presentation

Each oral presentation is limited to 15 minutes for **Regular Papers** and 30 minutes for **Invited Papers**. The duration includes 3-5 minutes Q&As.

You are required to log in the respective Zoom meeting at least 10 minutes prior to your session. The links of Zoom meetings are included in the Program Book.

## Presentation Mode

You can choose to do live presentation or play your pre-recorded presentation video. For pre-recorded video presentation, you can upload your pre-recorded video via EDAS. This step is optional. In this case, however, you are still encouraged to be present virtually for the Q&A.

All papers must be presented at the conference in order to be included in the proceedings published in IEEE Xplore<sup>®</sup>.

## Instructions for Session Chairs

Please keep in mind the time frame of each presentation and remind the presenter when appropriate.

## Time Zone

All the times in the technical program are based on Beijing Time (GMT +8).



# Best Student Paper Contest

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Based on the reviewers' scores and comments, as well as the relevance to the conference theme, 20 student papers are shortlisted. All contestants are to give an additional online presentation up to **7 minutes (4-minute presentation and 3-minute Q&A)** at 8:30 am to 11:30 am on Tuesday 17, 2022.

**08:30 - 11:30, Tue, May 17, 2022**

**Student Paper Contest**

**Room: Room 0**

**Chairs:** Xudong Chen, National University of Singapore, Singapore

Changzhi Li, Texas Tech University, USA

08:30-08:35 **Welcome and Introduction**

**TA-SPC-1 3-D Etching Techniques for Low-Cost Wearable Microwave Devices in Grounded Coplanar Waveguide**

08:35-08:42 Giulia Battistini, Giacomo Paolini and Diego Masotti (University of Bologna, Italy); Alessandra Costanzo (DEI, University of Bologna, Italy)

**TA-SPC-2 Electromagnetic Triggering with Microparticles for Application in Drug Delivery**

08:42-08:49 Mohammed Saad Shaikh, Robert Jones, Rostyslav Dubrovka (Queen Mary, University of London, United Kingdom)

**TA-SPC-3 Design Approach of a K-Band FMCW Radar for Breast Cancer Detection Using a Full System-Level EM Simulation**

08:49-08:56 Martin Maier, Finn-Niclas Stapelfeldt, Vadim Issakov (Technische Universität Braunschweig, Germany)

**TA-SPC-4 Method and Implementations to Measure the Absorbed Power Density**

08:56-09:03 Fariba Karimi, Sven Kuhn, Jingtian Xi (ETH Zürich & IT'IS Foundation, Switzerland); Sylvain Reboux (ZMT Zurich MedTech AG, Switzerland); Andreas Christ (Research Consultant, Brazil); Arya Fallahi (IT'IS Foundation, Switzerland); Romain Meyer (Schmid & Partner Engineering AG (SPEAG), Switzerland); Niels Kuster (IT'IS Foundation, Switzerland)

**TA-SPC-5 Assessment of Area-Average Absorbed Power Density on Realistic Tissue Models at mmWaves**

09:03-09:10 Ante Lojić Kapetanović (University of Split, Croatia); Giulia Sacco (IETR-Université de Rennes 1, France); Maxim Zhadobov (IETR/CNRS, France);

Dragan Poljak (University of Split, Croatia)

**TA-SPC-6 Microwave Interferometric On-Chip Measurement of the Collagen Gel**

09:10-09:17 Meng Zhang (University of Leuven & TELEMIC, ESAT, Belgium); Tomislav Markovic (University of Leuven, Belgium)

**TA-SPC-7 Compact Four-Element MIMO Antenna with High Isolation for High-Data-Rate Telemedicines**

09:17-09:24 Xin Ling and Xiongying Liu (South China University of Technology, China)

**TA-SPC-8 A Subcarrier Selection Method for Wi-Fi-Based Respiration Monitoring Using IEEE 802.11ac/Ax Protocols**

09:24-09:31 Ruilin Wang and Xiaolin Zhou (Harbin Institute of Technology, Shenzhen, China & National University of Singapore Suzhou Research Institute); Bo Wang, Zhi Zheng and Yongxin Guo (National University of Singapore, Singapore)

**TA-SPC-9 3D Printed Lens Antenna for Contactless Heartbeat and Respiration Detection Using mm-Wave Radar Sensing**

09:31-09:38 Jiexin Lai (University of Technology Sydney, Australia); Yuehang Sun (University of Electronic Science and Technology of China, China); Yang Yang (University of Technology Sydney, Australia)

**TA-SPC-10 Design of A Millimeter-Wave Physiotherapy System for the Adjuvant Therapy of Leukocytopenia**

09:38-09:45 Mingyi Yuan, Haidong Chen, Shuai Wang, Chengjian Zhang, Weijie Lin, Wenquan Che and Quan Xue (South China University of Technology, China)

09:45-10:10 **Break**

**TA-SPC-11 A Study on the Effect of Thorax Dilation in Microwave Thorax Imaging**

10:10-10:17 Haolin Zhang, Tong Zhang, Maokun Li, Fan Yang, Shenheng Xu, and Yeyu Cao (Tsinghua University, China)

**TA-SPC-12 A Novel Non-Contact Drunkenness Monitoring Method Based on A 24-GHz Interferometric Radar System**

10:17-10:24 Yangtao Ye (Shanghai Jiao Tong University, China); Jingtao Liu (Shanghai Jiao Tong University, Shanghai & MoE Key Lab of Artificial Intelligence, China); Zesheng Zhang, Changzhan Gu and Junfa Mao (Shanghai Jiao Tong University, China)

- TA-SPC-13 Grip Force Prediction Based on Changes in Brachioradialis Muscle Impedance**  
 10:24-10:31 Pan Xu, Xudong Yang and Hongli Yan (Fuzhou University, China); Željka Lučev Vasić and Mario Cifrek (University of Zagreb, Croatia); Yueming Gao (Fuzhou University, China)
- TA-SPC-14 Application of Electromagnetic Probe in Microwave Thermoacoustic Imaging**  
 10:31-10:38 Shuaiqi Qiao, Zheng Liang, Weipeng Wang and Huang Lin (University of Electronic Science and Technology of China, China)
- TA-SPC-15 Non-Contact Multi-Target Vocal Folds Vibration Detection Based on MIMO FMCW Radar**  
 10:38-10:45 Yue Ma, Hong Hong, Heng Zhao and Xiaohua Zhu (Nanjing University of Science and Technology, China)
- TA-SPC-16 Physics-Informed Deep Learning for Time-Domain Electromagnetic Radiation Problem**  
 10:45-10:52 Ge Yingze, G. L Shuai, Maokun Li (Tsinghua University, China)
- TA-SPC-17 Non-Contact Vital Sign Monitoring with a Metamaterial Surface**  
 10:52-10:59 Dat T. Nguyen, Qihang Zeng, Xi Tian, John Ho (National University of Singapore, Singapore)
- TA-SPC-18 Microwave Characterization and Probe Sensing: Parametric Study with Skin Phantom Thickness**  
 10:59-11:06 Jasmine Boparai, Yanis Jallouli, Oliver Miller, Rachel Tchinov and Milica Popović (McGill University, Canada)
- TA-SPC-19 Implementation of Intermediate Passive Loop Coil to Extend the Range of Qi Charging**  
 11:06-11:13 Mahfuzur Rahman and Bashir I Morshed (Texas Tech University, USA)
- TA-SPC-20 The Design and SAR Analysis of Wearable UWB Antenna for Radiative Near-Field Wireless Power Transfer**  
 11:13-11:20 Karthik Kakaraparty, Ifana Mahbub (The University of North Texas, USA)

# Plenary Speech

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**MA0A-1 (Monday, 09:00-09:45am, May 16, 2022)**

## **Advances in Antenna and Sensor Developments in Modern Medical Applications: Ergonomic MRI Neck Coils and Microwave Ablation Lung-Tuned Antennas**

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**Professor Yahya Rahmat-Samii**  
**Distinguished Professor**  
**University of California Los Angeles, USA**  
**Member of the U.S. National Academy of Engineering**  
**Foreign Member of the Chinese Academy of Engineering (CAE)**  
**Fellow of IEEE**

Professor Yahya Rahmat-Samii is a Distinguished Professor, a holder of the Northrop-Grumman Chair in electromagnetics, a member of the U.S. National Academy of Engineering (NAE), a Foreign Member of the Chinese Academy of Engineering (CAE) and the Royal Flemish Academy of Belgium for Science and the Arts, the winner of the 2011 IEEE Electromagnetics Field Award, and the Former Chairman of the Electrical Engineering Department, University of California at Los Angeles (UCLA), Los Angeles, CA, USA. He was a Senior Research Scientist with the Caltech/NASA's Jet Propulsion Laboratory. He has authored or coauthored more than 1100 technical journal and conference papers and has written over 36 book chapters and six books and is the holder many patents. He has more than 20 cover-page IEEE publication articles. Dr. Rahmat-Samii received his B.S. degree from University of Tehran and M.S. and Ph.D. degrees from the University of Illinois, Urbana-Champaign, USA.

Prof. Rahmat-Samii is a fellow of IEEE, AMTA, ACES, EMA, and URSI. He was a recipient of the Henry Booker Award from URSI, in 1984, which is given triennially to the most outstanding young radio scientist in North America, the Best Application Paper Prize Award (Wheeler Award) of the IEEE Transactions on Antennas and Propagation in 1992 and 1995, the University of Illinois ECE Distinguished Alumni Award in 1999, the IEEE Third Millennium Medal and the AMTA Distinguished Achievement Award in 2000. In 2001, he received an Honorary Doctorate Causa from the University of Santiago de Compostela, Spain. He received the 2002 Technical Excellence Award from JPL, the 2005 URSI Booker Gold Medal presented at the URSI General Assembly, the 2007 IEEE Chen- To Tai Distinguished Educator Award, the 2009 Distinguished Achievement Award of the IEEE Antennas and Propagation Society, the 2010 UCLA School of Engineering Lockheed Martin Excellence in Teaching Award, and the 2011 campus-wide UCLA Distinguished Teaching Award. He was also a recipient of the Distinguished Engineering Educator Award from The Engineers Council in 2015, the John Kraus Antenna Award of the IEEE Antennas and Propagation Society and the NASA Group Achievement Award in 2016, the ACES Computational Electromagnetics Award and the IEEE Antennas and Propagation S. A. Schelkunoff Best Transactions Prize Paper Award in 2017. Rahmat-Samii was the recipient of the prestigious Ellis Island Medal of Honor in 2019. The medals are awarded annually to a group of distinguished U.S. citizens who exemplify a life

dedicated to community service. These are individuals who preserve and celebrate the history, traditions, and values of their ancestry while exemplifying the values of the American way of life and are dedicated to creating a better world. Among the recipients of this honor are seven US presidents to name the few. He is listed in Who's Who in America, Who's Who in Frontiers of Science and Technology and Who's Who in Engineering. He has been a plenary and millennium session speaker at numerous national and international symposia. He has been the organizer and presenter of many successful short courses worldwide. Many of his students have won major theses and conference paper awards.

He has had pioneering research contributions in diverse areas of electromagnetics, antennas, measurements and diagnostics techniques, numerical and asymptotic methods, satellite and personal communications, human/antenna interactions, RFID and implanted antennas in medical applications, frequency-selective surfaces, electromagnetic band-gap and meta-material structures, applications of the genetic algorithms and particle swarm optimizations. He is the designer of the IEEE Antennas and Propagation Society logo which is displayed on all IEEE AP-S publications. He was the 1995 President of the IEEE Antennas and Propagation Society and 2009–2011 President of the United States National Committee (USNC) of the International Union of Radio Science (URSI). He has also served as an IEEE Distinguished Lecturer presenting lectures internationally.

**Abstract:** It is strongly anticipated that the twenty-first century will be glorified as the dawn of convergence of engineering technology and its profound infusion into modern medical practice. Customized antennas and sensors are going to be evaluated as paramount components in making this infusion functional and practical. This plenary talk will provide an overview of recent advances in this arena based on the research work conducted at the author's laboratory [1] and a recently edited book [2] by the author discussing the fundamentals and the state-of-the-art developments in antennas and sensors in medical applications. Two representative examples will be detailed to demonstrate the potential utilities of (a) Customized Ergonomic 3-T MRI Neck Coils and (b) Tailored Microwave Ablation Lung-Tuned Antennas.

(a) Recent statistics suggests that in the United States stroke happens around every 40 seconds and it is estimated that one out of four is related to carotid artery diseases. Magnetic Resonance Imaging (MRI) is one of the most powerful imaging modalities and is essential for the diagnosis through carotid artery imaging. MRI RF coils that are more conformal to the imaging area anticipated to provide better image quality. Without the RF coils that are highly conformal, human areas with large curvature signature such as neck, wrist, knee, and shoulder cannot be easily accessed unless image quality is compromised. The fundamental limiting factor for high quality MR imaging is the Signal to Noise Ratio (SNR) performance of the Radio Frequency (RF) coils. The SNR of surface RF coils is very sensitive to the placement of the coil relative to the imaging tissue. When our novel flexible coil is placed conformal to the imaging tissue, higher SNR is achieved and better image quality is obtained. Biosafety approval was obtained for human cadaver research using our novel flexible coil design with satisfactorily achieved high quality images.

(b) Lung cancer remains one of the leading causes of cancer deaths among men and women, comprising of nearly 25% of all cancer deaths. The image-guided thermal ablation procedure

has been attractive option due to its proven fewer complications, quicker recovery and minimal blood loss. In performing thermal ablation, energy is radiated by an antenna or applicator under image guidance toward target tumor tissue. In practice ablation process continues until the tumor tissue is heated to required temperatures with consideration given to minimizing damage to normal surrounding tissues. One of the key questions has been how to optimize the ablation antenna for different organs. Recently we have applied [3] an analytical solution to optimize a monopole antenna to transmit energy efficiently into the dielectric load of an air-expanded lung while maintaining a spherical ablation zone. This lung-tuned antenna was then used to create microwave ablation zones in a ventilator-controlled ex vivo porcine lung and its performance has been evaluated against a liver-tuned antenna. It has been experimentally demonstrated that the optimized antenna design provided much improved performance. We believe this work lays the foundation for adaptive tissue-tuning for real-time microwave antenna ablation applications.

[1] Y. Rahmat-Samii and Lingnan Song, "Advances in Communication and Biomedical Antenna Developments at the UCLA Antenna Lab: Handheld, Wearable, Ingestible, and Implantable [Bioelectromagnetics]," IEEE Antennas and Propagation Magazine, October 2021.

[2] Y. Rahmat-Samii and E. Topsakal, Antenna and Sensor Technologies in Modern Medical Applications, Wiley-IEEE Press, 2021.

[3] J. Chiang, L. Song, F. Abtin and Y. Rahmat-Samii, "Efficacy of Lung-Tuned Monopole Antenna for Microwave Ablations: Analytical Solution and Validation in a Ventilator-Controlled exVivo Porcine Lung Model," IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology, March 2021.

# Plenary Speech

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**MA0A-2 (Monday, 09:45-10:30am, May 16, 2022)**

## **Translational Research on Deep Brain Stimulation**

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**Professor Luming Li,  
Cheung Kong Scholar Chair Professor  
National Engineering Research Center of Neuromodulation  
Tsinghua University, China**

Dr. Li graduated from Tsinghua University in 1991, and obtained his Ph. D. in Tsinghua in 1996. And then as a faculty working in department of mechanical engineering, Tsinghua university. Currently, he is Cheung Kong Scholar Chair Professor and the foundering director of National Engineering Research Center of Neuro-modulation. He is one of three founders and vice president of Chinese Society of Neuromodulation.

As a leader of a multi-disciplinary research group at Tsinghua University, he tries to provides innovative and affordable neuromodulation techniques for patients in developing countries. He invented variable frequency stimulation (VFS) for Parkinson's Disease and the other movement disorders. To help the patients in un-developed areas in China, he invented remote programming techniques-- a unique secure web-based remote wireless programming system. The unique device with tele-programming and VFS was widely used in China. Till the end of 2021, more than 15000 patients with Parkinson's Disease, dystonia and etc. were implanted his devices in over 310 medical centers in China. He was awarded First prize of National Science and Technology Progress Award, China, 2018.

**Abstract:** Deep brain stimulation (DBS) is the only technique that can directly modulate brain activities using electrical stimulation. Numerous studies have shown that DBS not only causes a direct effect on the target nuclei, but somehow modulates pathological oscillations that reverberate through multiple brain regions. As such, this provides great opportunities for understanding brain activity in human behaviors.

This talk will summarize the developing of DBS in China, particularly the device progress. Two innovation points will be highlighted. One is the 'Various Frequency Stimulation (VFS)'. Comparing the conventional High Frequency Stimulation (HFS), unable to alleviate certain symptoms, such as freezing of gait (FOG) and dysarthria, VFS showed some unique progress on FOG. The other is remote programming. To solve the problems that patients in un-developed areas in China need back to operation center for device programming, an invention of a unique secure web-based remote wireless programming system will be presented.

To build DBS as brain diseases research tool, we have established a new platform that not only

provides DBS therapy but also gives concurrent measurements of local field potential signals to investigate neural circuits. This research tool is like an implanted brain recorder that may allow us to answer vital questions related with various brain disorders and different brain states in combination with behavioral evaluations. The long term modulation effect to STN will be presented in this talk. Another interesting issue is sleeping. Could the recording signals of STN be used for sleeping stage identification? The point is also discussed.

Another important issue in DBS neurosurgery is MRI compatibility, which not only relates to clinical practice but also brain research. Following numerous simulations and experiments, an updated device which could be compatible with 3T MRI, not only safety to scan when turning off the power but scan while turning on also. Using this platform, some new finding about DBS mechanism will be discussed in this talk.

Lastly, the progress of DBS as a special brain-computer interface will be presented.



# Plenary Speech

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MA0B-1 (Monday, 10:40-11:25am, May 16, 2022)

## Advances in Computational and Experimental Bioelectromagnetics for Healthcare: Sensors and Neurointerfaces

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**Professor Gianluca Lazzi**  
**University of Southern California, USA**  
**Fellow of IEEE**

Gianluca Lazzi, PhD, MBA, is a Provost Professor of Ophthalmology, Electrical Engineering, Clinical Entrepreneurship and Biomedical Engineering at the University of Southern California (USC) where he is also the holder of the Fred H. Cole Professorship and the Director of the Institute for Technology and Medical Systems (ITEMS), a joint initiative of the Keck School of Medicine and the Viterbi School of Engineering. His expertise is in antenna design, medical applications of electromagnetics, implantable devices, neuroengineering, wireless telemetry, and liquid metal sensors. He is a Fellow of the IEEE, a Fellow of the American Institute for Medical and Biological Engineering (AIMBE), and a Fellow of the National Academy of Inventors (NAI). He co-founded Teveri, Inc, which is focused on the commercialization of stretchable conductive liquid metal-based fibers knitted in clothing and athletic apparel to bring seamless biometric, sensing and illumination solutions to smart clothing as well as stretchable electronic systems for medical, consumer, and military applications. He is the President of the IEEE Antennas and Propagation Society.

**Abstract:** Although technical challenges are still daunting, the clinical utility of neuroprosthetics has increased dramatically over the past few years. This has been accomplished through the convergence of numerous disciplines, which have individually added fundamental understanding/capabilities to systems that interface with the human body to restore senses and movement, or treat prevalent diseases that have currently no foreseeable cure. Among these, predictive multiscale computational modeling methods have greatly aided in the design of neuroprosthetics by embracing the complexity of the nervous system, which span multiple spatial scales, temporal scales, and disciplines. In this talk, we will cover some of the recent advances in bioelectromagnetic systems for healthcare, with a particular focus on visual and hippocampal prosthesis, peripheral neuroprosthetics, and sensors.

# Plenary Speech

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**MA0B-2 (Monday, 10:25am-12:10pm, May 16, 2022)**

## **Ultra-High Field Human Whole-Body 5.0 Tesla Magnetic Resonance Imaging System and Clinical Trials**

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**Professor Hairong Zheng**  
**Shenzhen Institutes of Advanced Technology**  
**Chinese Academy of Sciences, China**

Dr. Hairong Zheng obtained his B.S. and M.S. degree from Harbin Institute of Technology. He earned his Ph.D. degree at University of Colorado at Boulder in 2006 with the partial support from American Heart Association (AHA) Predoctoral Fellowship. He did his postdoctoral training at University of California, Davis in 2007. In the same year, he joined Shenzhen Institutes of Advanced Technology (SIAT), Chinese Academy of Sciences (CAS), where he is presently Deputy Director and a Professor. He leads the Paul C. Lauterbur Research Center for Biomedical Imaging at SIAT. He is the Director of National Innovation Center for Advanced Medical Devices. Dr. Zheng currently conducts research primarily in the area of biomedical imaging technology. Its thrust is on developing fast high-field MRI imaging technologies and system, and multifunctional ultrasonic imaging systems that can be used for elastography, molecular imaging, neuromodulation. Dr. Zheng has published 260 peer-reviewed journal articles, and held more than 100 issued patents based his research, some of which have been translated to commercial products for clinical use. He served as the editorial board member for Physics in Medicine and biology. He was also the associate editor of IEEE Transactions on UFFC.

# Distinguished Lecture

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WA0B-1 (Wednesday, 10:40-11:25am, May 18, 2022)

## Portable Radar Systems for Life Activity Sensing, Anomaly Detection, and Human Tracking

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Professor Changzhi Li  
Texas Tech University, USA

Changzhi Li received the Ph.D. degree in electrical engineering from the University of Florida, Gainesville, FL, in 2009. He is a Professor at Texas Tech University. His research interest is microwave/millimeter-wave sensing for healthcare, security, and human-machine interface.

Dr. Li is a Microwave Theory and Techniques Society (MTT-S) Distinguished Microwave Lecturer. He was a recipient of the IEEE Microwave Theory and Techniques Society (MTT-S) Outstanding Young Engineer Award, the IEEE Sensors Council Early Career Technical Achievement Award, the ASEE Frederick Emmons Terman Award, the IEEE-HKN Outstanding Young Professional Award, and the U.S. National Science Foundation (NSF) Faculty CAREER Award. He is an Associate Editor of the IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES and the IEEE JOURNAL OF ELECTROMAGNETICS, RF AND MICROWAVES IN MEDICINE AND BIOLOGY. He is the TPC chair of the 2022 IEEE Radio & Wireless Week. He served as the chair of the MTT-S Technical Committee “Biological Effect and Medical Applications of RF and Microwave” from 2018 to 2019, a TPC Co-Chair for the IEEE MTT-S International Microwave Biomedical Conference from 2018 to 2019, and the IEEE Wireless and Microwave Technology Conference from 2012 to 2013.

**Abstract:** By sensing various life activities with microwave signals, portable radar sensors with state-of-the-art front-end and measurement algorithms have great potential to improve healthcare, security, and human-machine interface. This presentation will first provide an overview on the state-of-the-art smart radar sensors powered by advanced digital/RF beamforming, multiple-input and multiple-output (MIMO), synthetic aperture radar (SAR), inverse synthetic-aperture radar (ISAR), and deep learning. A few examples based on interferometry, Doppler, frequency-shift keying (FSK), and frequency-modulated continuous-wave (FMCW) modes at 5.8 GHz, 24 GHz, and 120 GHz will be discussed. In addition, the use of nonlinear technologies will be reported, with a focus on in-band third-order intermodulation measurement for enhanced target identification and parameter extraction. Case studies at this exciting human-microwave frontier will be given on physiological signal sensing, non-contact human-computer interface, driving behavior recognition, human tracking, and anomaly detection.

As smart radar sensors enter the healthcare, transportation, and smart living sectors of daily life, measures to enhance its security against malicious attacks are of paramount importance. This part of the talk will discuss possible ways of malicious attacks based on spoofing and jamming to radar sensors. Then technologies that mitigate potential attacks will be unveiled to make smart radar sensors more secure and trustworthy. Finally, this talk will conclude with future industrial and academic R&D outlooks for microwave short-range life activities sensing.

# Distinguished Lecture

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WA0B-2 (Wednesday, 11:25am-12:10pm, May 18, 2022)

## The History and Future of Implantable Antennas

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**Professor Cynthia Furse**  
**University of Utah, USA**  
**Fellow of IEEE**

Dr. Cynthia M. Furse is a Fellow of the IEEE and the National Academy of Inventors, and is a Professor of Electrical and Computer Engineering at the University of Utah, Salt Lake City, Utah, USA. Her research interests are the application of electromagnetics to sensing and communication in complex lossy scattering media such as the human body, geophysical prospecting, ionospheric plasma, and complex wiring networks. Dr. Furse is a founder of LiveWire Innovation, Inc., a spin-off company from her research, commercializing devices to locate intermittent faults on live wires. She has taught electromagnetics, wireless communication, computational electromagnetics, microwave engineering, antenna design, introductory electrical engineering, and engineering entrepreneurship and has been a leader in the development of the flipped classroom. Dr. Furse is an Associate Editor for the Transactions on Antennas and Propagation (AP), a member of the IEEE AP Young Professionals Committee, a past Administrative Committee member for the IEEE AP society, and past chair of the IEEE AP Education Committee. She has received numerous teaching and research awards including the 2020 IEEE Chen To Tai Distinguished Educator Award.

**Abstract:** Implantable antennas have been used for communication with medical implants for decades. Since then, wireless medical telemetry systems and their associated implantable antennas have expanded rapidly. Implantable medical devices now touch virtually every major function in the human body. Cardiac pacemakers and defibrillators, neural recording and stimulation devices, cochlear and retinal implants are just a few of the many implantable medical devices available today. Wireless telemetry for these devices is necessary to monitor battery level and device health, upload reprogramming for device function, and download data for patient monitoring.

Emerging medical telemetry devices have led to recent advances in the design of small, biocompatible antennas that can be implanted in the human body. This paper will track the types of antennas seen in the past, the technologies that enabled these changes, and prospects for future implantable antennas for medical applications.

# IEEE IMBioC 2022 Technical Program

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08:40 - 12:10\*, Mon, May 16, 2022

Room: Room 0

08:40-09:00

## Opening Ceremony

09:00-10:30

## Session MA0A: Plenary Speech I

### Chairs:

J.-C. Chiao, Southern Methodist University, USA

John Ho, National University of Singapore, Singapore

### MA0A-1

**Advances in Antenna and Sensor Developments in Modern Medical Applications: Ergonomic MRI Neck Coils and Microwave Ablation Lung-Tuned Antennas (Plenary)**

09:00-09:45

Yahya Rahmat-Samii (University of California, Los Angeles, USA)

### MA0A-2

**Translational Research on Deep Brain stimulation (Plenary)**

09:45-10:30

Luming Li (Tsinghua University, China)

10:30-10:40

**Break**

10:40-12:10

## Session MA0B: Plenary Speech II

### Chairs:

Wen Wu, Nanjing University of Science and Technology, China

Xiong Wang, ShanghaiTech University, China

### MA0B-1

**Advances in Computational and Experimental Bioelectromagnetics for Healthcare: Sensors and Neurointerfaces (Plenary)**

10:40-11:25

Gianluca Lazzi (University of Southern California, USA)

### MA0B-2

**Ultra-high field human whole-body 5.0 Tesla magnetic resonance imaging system and clinical trials (Plenary)**

11:25-12:10

Hairong Zheng (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China)

\*All the times in the technical program are based on Beijing Time (GMT

**10:10 - 10:40, Wed, May 18, 2022**

**Room:** Room 0

10:10 - 10:40

**Closing & Award Ceremony**

**10:40 - 12:10, Wed, May 18, 2022**

**Room:** Room 0

10:40-12:10

**Session WA0B: Distinguished Lectures**

**Chairs:**

Jiang Zhu, Meta Platforms, USA

Yue Li, Tsinghua University, China

**WA0B-1**

**Portable Radar Systems for Life Activity Sensing, Anomaly Detection,  
and Human Tracking**

10:40 - 11:25

Changzhi Li (Texas Tech University, USA)

**WA0B-2**

**The History and Future of Implantable Antennas**

11:25 - 12:10

Cynthia Furse (University of Utah, USA)

13:30 - 15:30, Mon, May 16, 2022

Special Session: MP1A

Recent Progress in Biomedical Radar

Room: Room 1

**Organizer:** Hong Hong, Nanjing University of Science and Technology, China

**Chairs:** Hong Hong, Nanjing University of Science and Technology, China  
Chuanwei Ding, Nanjing University of Science and Technology, China

**MP1A-1 Recent Progress in Radar-Based Multi-Targets' Vital Sign Detection (Invited)**

13:30-14:00 Hong Hong, Heng Zhao and Xiaohua Zhu (Nanjing University of Science and Technology, China)

**MP1A-2 Accurate Pulse Wave Signal Detection Based on DC Offset Calibration Using Non-Convex Optimization**

14:00-14:15 Zicheng Wang, Heng Zhao, Yuanren Ma, Yue Ma, Hong Hong and Xiaohua Zhu (Nanjing University of Science and Technology, China)

**MP1A-3 Non-Contact Multi-Target Vocal Folds Vibration Detection Based on MIMO FMCW Radar**

14:15-14:30 Yue Ma, Hong Hong, Heng Zhao and Xiaohua Zhu (Nanjing University of Science and Technology, China)

**MP1A-4 Human Activity Recognition Using Temporal 3DCNN Based on FMCW Radar**

14:30-14:45 Haoyu Chen, Chuanwei Ding, Li Zhang, Hong Hong and Xiaohua Zhu (Nanjing University of Science and Technology, China)

**MP1A-5 A Novel Non-Contact Drunkenness Monitoring Technique Based on A 24-GHz Interferometric Radar System**

14:45-15:00 Yangtao Ye and Lina Ma (Shanghai Jiao Tong University, China); Jingtao Liu (Shanghai Jiao Tong University, Shanghai & MoE Key Lab of Artificial Intelligence, China); Zesheng Zhang, Changzhan Gu and Junfa Mao (Shanghai Jiao Tong University, China)

**MP1A-6 Circuit, Antenna, and Algorithm Co-Design of CMOS-Integrated Coherent FMCW Radar Sensing Platform for Edge Vital Signs**



## **Monitoring**

15:00-15:15 Zhongyuan Fang, Kai Tang, Wensong Wang, Liheng Lou and Yuanjing Zheng (Nanyang Technological University, Singapore)

### **MP1A-7 A Simple Joint MUSIC-Phase Difference Fitting DOA Estimation Method**

15:15-15:30 Wentao Zhang, Chen Miao and Wen Wu (Nanjing University of Science and Technology, China); Yue Ma (Nanjing University of Science and Technology & Ministerial Key Laboratory of JGMT, China)

13:30 - 15:30, Mon, May 16, 2022

Special Session: MP2A

Advanced Technologies for Microwave Medical Sensing and Wearable Devices

Room: Room 2

- Organizers:** Yang Yang, University of Technology Sydney, Australia  
Sasan Ahdi Rezaeieh, University of Queensland, Australia
- Chairs:** Yang Yang, University of Technology Sydney, Australia  
Sasan Ahdi Rezaeieh, University of Queensland, Australia
- MP2A-1      **Advanced Manufacturing Techniques for Wearable Devices and Antennas (Invited)****
- 13:30-14:00      Yang Yang (University of Technology Sydney, Australia)
- MP2A-2      **Modelling the Performance of Wearable Antenna Using Hybrid SNFT-FDTD Method****
- 14:00-14:15      Yinliang Diao, Chu Chen and Shilei Lv (South China Agricultural University, China)
- MP2A-3      **3D Printed Lens Antenna for Contactless Heartbeat and Respiration Detection Using mm-Wave Radar Sensing****
- 14:15-14:30      Jiexin Lai (University of Technology Sydney, Australia); Yuehang Sun (University of Electronic Science and Technology of China, China); Yang Yang (University of Technology Sydney, Australia)
- MP2A-4      **A PDMS-Based Low-Profile Monopole Antenna for Wearable Applications****
- 14:30-14:45      Purna B. Samal (The University of Adelaide, Australia); Shengjian Jammy Chen (Flinders University, Australia & The University of Adelaide, Australia); Christophe Fumeaux (The University of Adelaide & School of Electrical and Electronic Engineering, Australia)
- MP2A-5      **Design of A Millimeter-Wave Physiotherapy System for the Adjuvant Therapy of Leukocytopenia****
- 14:45-15:00      Mingyi Yuan, Haidong Chen, Shuai Wang, Chengjian Zhang, Weijie Lin, Wenquan Che and Quan Xue (South China University of Technology, China)

**MP2A-6      Wirelessly Operated Flexible Sensing Tag for Continuous Wound Infection Monitoring**

15:00-15:15    Ze Xiong and John Ho (National University of Singapore, Singapore)

**MP2A-7      Detection of Low Back Muscle State Based on Electrical Impedance Myography**

15:15-15:30    Jingting Shi, Yanyan Liu, Hongli Yan and Yueming Gao (Fuzhou University, China); Željka Luč ev Vasić    and Mario Cifrek (University of Zagreb, Croatia)

13:30 - 15:30, Mon, May 16, 2022

Special Session: MP3A

Microwave Biomedical Imaging Methods and Systems

Room: Room 3

- Organizers:** Kuiwen Xu, Hangzhou Dianzi University, China  
Xiuzhu Ye, Beijing Institute of Technology, China
- Chairs:** Kuiwen Xu, Hangzhou Dianzi University, China  
Xiuzhu Ye, Beijing Institute of Technology, China
- MP3A-1**      **Challenges of Translating Electromagnetic Medical Imaging Techniques From Bench to Bedside (Invited)**  
13:30-14:00      Amin Abbosh (The University of Queensland, Australia)
- MP3A-2**      **1.3-GHz Antenna Array for Focused Microwave Breast Hyperthermia and Microwave-Induced Thermoacoustic Imaging**  
14:00-14:15      Zijun Xi and Xiong Wang (ShanghaiTech University, China)
- MP3A-3**      **Electromagnetic Inverse Scattering With an Untrained Neural Network**  
14:15-14:30      Meilan Li and Rencheng Song (Hefei University of Technology, China)
- MP3A-4**      **Physical-Based Deep Unrolling Network for Solving Full-Wave Inverse Scattering Problems**  
14:30-14:45      Hao Zhao, Yu Liu and Rencheng Song (Hefei University of Technology, China)
- MP3A-5**      **Real-Time Monitoring of Vital Signs Based on Miniaturized Ultra-Wideband Radar**  
14:45-15:00      Yuchao Guo, Naike Du and Xiuzhu Ye (Beijing Institute of Technology, China)
- MP3A-6**      **Super-Resolution Microwave Biomedical Imaging With Contraction Integral Equation Models**  
15:00-15:15      Kuiwen Xu, Lu Zhang and Qian Zeming (Hangzhou Dianzi University, China); Yu Zhong (FINIAC Pte. Ltd., Singapore)
- MP3A-7**      **A Study on the Effect of Thorax Dilation in Microwave Thorax Imaging**

15:15-15:30 Haolin Zhang, Tong Zhang, Maokun Li, Fan Yang, Shenheng Xu, and Yeyu Cao (Tsinghua University, China)

15:40 - 17:40, Mon, May 16, 2022

Special Session: MP1B

Planar and Chip-Based RF & MW Devices for Liquid Biosample Analysis and  
Manipulation

Room: Room 1

**Organizer:** Michal Cifra, Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Republic

**Chairs:** Michal Cifra, Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Republic  
Arnaud Pothier, University of Limoges, France

**MP1B-1 Approaches for Understanding of Pulsed Electric Field Interaction With Cytoskeleton (Invited)**

15:40-16:10 Daniel Havelka, Jiří Průša and Michal Cifra (Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Republic)

**MP1B-2 Ultra-High Frequency Dielectrophoresis Manipulation to Monitor the Kinetics of Glioblastoma Cells Stemness Phenotype Acquisition**

16:10-16:25 Elisa Lambert (Xlim, University of Limoges, France); Elodie Barthout (CAPTuR-EA 3842, University of Limoges, France); Rémi Manczak (Xlim, University of Limoges, France); Sofiane Saada (CAPTuR-EA 3842, University of Limoges, France); Barbara Bessette (University of Limoges, France); Muriel Mathonnet (CAPTuR - EA3842, University of Limoges, France); Claire Dalmay (XLIM - CNRS - Université de Limoges, France); Fabrice Lalloue (University of Limoges, France); Arnaud Pothier (University of Limoges, France)

**MP1B-3 Split-Ring Microwave Resonator-Based Method for Permittivity Extraction of Small Volume Biomolecular Solutions**

16:25-16:40 Petr Kurka (UFE - Institute of Photonics and Electronics, Czech Republic); Abhishek Jha (IIT Tirupati, Poland); Daniel Havelka and Michal Cifra (Institute of Photonics and Electronics of the Czech Academy of Sciences, Czech Republic)

- MP1B-4      Microwave Interferometric On-Chip Measurement of the Collagen Gel**
- 16:40-16:55    Meng Zhang (University of Leuven & TELEMIC, ESAT, Belgium); Tomislav Markovic (University of Leuven, Belgium)
- MP1B-5      From Flexible Wire Electrodes to Coplanar Waveguides for Intense Electromagnetic Fields Exposures**
- 16:55-17:10    Philippe Leveque (CNRS & XLIM, France); Delia Arnaud-Cormos (University of Limoges, CNRS, XLIM, France); Rosa Orlacchio and Claire Dalmay (University of Limoges, CNRS XLIM, France)
- MP1B-6      DEP Cytometer Measurement of the Effect of Medium Conductivity on Viable and Non-Viable Cell Dielectric Properties**
- 17:10-17:25    Greg Bridges, Samaneh Afshar, Behnam Arzhang, Katrin Braasch, Sara Absalan, Emerich Kovacs, Elham Salimi, Michael Butler and Douglas Thomson (University of Manitoba, Canada)
- MP1B-7      Investigating the Potential of a Planar Non-Contact Microwave Biosensor for Detection and Differentiation of Microorganisms**
- 17:25-17:40    Mandeep Chhajer Jain and Mohammad Zarifi (University of British Columbia, Canada)

15:40 - 17:40, Mon, May 16, 2022

Session: MP2B

WPT for Biomedical Applications

Room: Room 2

- Chairs:** Hao Zhang, Northwestern Polytechnical University, China  
Toni Björninen, Tampere University, Finland
- MP2B-1      *Antennas and Wireless Power Transfer to Small Biomedical Brain Implants (Invited)***
- 15:40-16:10    Leena Ukkonen, Lauri Sydänheimo, Toni Björninen, Stefanus Wirdatmadja and Nikta Pournoori (Tampere University, Finland); Merja Voutilainen (University of Helsinki, Finland)
- MP2B-2      *Application of Wireless Power Transfer Technology to Implantable Medical Devices (Invited)***
- 16:10-16:40    Haerim Kim, Jangyong Ahn, Jaewon Rhee and Seungyoung Ahn (Korea Advanced Institute of Science and Technology, Korea)
- MP2B-3      *Design of Simultaneous Multi-Beam Forming Method***
- 16:40-16:55    Xiaoli Zhi, Ke Huang and Lixin Ran (Zhejiang University, China)
- MP2B-4      *Omnidirectional Wireless Power Charging System for Capsule Endoscopy***
- 16:55-17:10    Chen Gao (National University of Singapore, Singapore); Hao Zhang (Northwestern Polytechnical University, China); Yong-xin Guo (National University of Singapore, Singapore)
- MP2B-5      *Wireless Resonant Energy Link for Joint Flexion Monitoring: Experimental Investigation by Using a NanoVNA***
- 17:10-17:25    Giuseppina Monti (University of Salento, Italy); Nizar Brahim (University of Salento & University of Tunis El Manar, Italy); Luciano Tarricone (University of Salento, Italy)



15:40 - 17:40, Mon, May 16, 2022

**Special Session: MP3B**

**Facing Challenges in Electromagnetic Dosimetry at Millimeter Waves and THz**

**Room:** Room 3

**Organizers:** Maxim Zhadobov, IETR/CNRS, France  
Giulia Sacco, IETR-Université de Rennes 1, France  
Akram Alomainy, Queen Mary University of London, United Kingdom

**Chairs:** Maxim Zhadobov, IETR/CNRS, France  
Giulia Sacco, IETR-Université de Rennes 1, France  
Akram Alomainy, Queen Mary University of London, United Kingdom

**MP3B-1 Facing Challenges of Local Multi-Scale and Multi-Physics Dosimetry at Millimeter Waves (Invited)**

15:40-16:10 Maxim Zhadobov (IETR/CNRS, France)

**MP3B-2 Human Skin Exposure to Terahertz Waves From 0.1 to 1 THz: Statistical Assessments Using Multilayered Planar Models**

16:10-16:25 Kensuke Sasaki (National Institute of Information and Communications Technology, Japan); Kun Li (Kagawa University, Japan); Tomoaki Nagaoka (National Institute of Information and Communications Technology, Japan)

**MP3B-3 Development of Exposure System for Evaluation of Thermal Effect at Millimeter Wave**

16:25-16:40 Sachiko Kodera and Akimasa Hirata (Nagoya Institute of Technology, Japan)

**MP3B-4 On Fast Estimation of SAR for Metallic Rim-Based MIMO Handsets**

16:40-16:55 Muhammad Ali Jamshed, Masood Ur-Rehman (University of Glasgow, United Kingdom)

**MP3B-5 Age, Textile and Body Curvature Impact on Absorbed Power Density at mmW**

16:55-17:10 Giulia Sacco (IETR-Université de Rennes 1, France); Maxim Zhadobov (IETR/CNRS, France)

**MP3B-6      Assessment of Area-Average Absorbed Power Density on Realistic Tissue Models at mmWaves**

17:10-17:25    Ante Lojić    Kapetanović    (University of Split, Croatia); Giulia Sacco (IETR-Université de Rennes 1, France); Maxim Zhadobov (IETR/CNRS, France); Dragan Poljak (University of Split, Croatia)

**MP3B-7      Increase of Absorbed Power Density Due to Antenna/Body Coupling at 60 GHz**

17:25-17:40    Massinissa Ziane (Univ Rennes & IETR, France); Maxim Zhadobov (IETR/CNRS, France); Ronan Sauleau (University of Rennes 1, France)

08:30 - 10:15, Tue, May 17, 2022

Session: TA1A

Radar for Biomedical Applications

Room: Room 1

- Chairs:** Lianming Li, Southeast University, China  
Chung-Tse Michael Wu, Rutgers University, USA
- TA1A-1      Recent Development of Super-Regenerative Oscillator (SRO)-Based Vital Sign Radar Sensors (Invited)**
- 08:30-09:00      Yichao Yuan and Chung-Tse Michael Wu (Rutgers University, USA)
- TA1A-2      A 60-GHz Hybrid FMCW-Doppler Radar in 65nm CMOS for Vital Sign Monitoring (Invited)**
- 9:00-9:30      Lin Lu (Southeast University, China); Xujun Ma (Télécom SudParis, Institut Polytechnique de Paris, Évry, France); Xuewei Fan, Ranbaqiao Hao and Xiangning Fan (Southeast University, China); Lianming Li (Southeast University, China; Purple Mountain Laboratories, Nanjing, China)
- TA1A-3      Radar-Based Blood Pressure Estimation Using Multiple Features**
- 09:30-09:45      Haotian Shi, Jiasheng Pan, Zhi Zheng, Bo Wang, Cheng Shen and Yongxin Guo (National University of Singapore, Singapore)
- TA1A-4      Non-Contact Calibration-Free Blood Pressure Estimation Method Using Dual Radar**
- 09:45-10:00      Zhi Zheng, Bo Wang and Yongxin Guo (National University of Singapore, Singapore)
- TA1A-5      High-Accuracy Contactless Detection of Eyes' Activities Based on Short-Range Radar Sensing**
- 10:00-10:15      Lina Ma, Yangtao Ye, Changzhan Gu and Junfa Mao (Shanghai Jiao Tong University, China)

08:30 - 10:15, Tue, May 17, 2022

Special Session: TA2A

WPT Schemes for Implantable and Wearable Sensors

Room: Room 2

- Organizers:** Asimina Kiourti, The Ohio State University, USA  
Ifana Mahbub, University of North Texas, USA
- Chairs:** Asimina Kiourti, The Ohio State University, USA  
Ifana Mahbub, University of North Texas, USA
- TA2A-1      Fully-Passive Brain Implants: Opportunities and Challenges (invited)**  
08:30-09:00      Asimina Kiourti (The Ohio State University, USA)
- TA2A-2      Implementation of Intermediate Passive Loop Coils to Extend the  
Range of Qi Wireless Charging**  
09:00-09:15      Mahfuzur Rahman and Bashir I Morshed (Texas Tech University, USA)
- TA2A-3      The Design and SAR Analysis of Wearable UWB Antenna for Radiative  
Near-Field Wireless Power Transfer**  
09:15-09:30      Karthik Kakaraparty (University of North Texas, USA); Ifana Mahbub (The  
University of North Texas, USA)
- TA2A-4      A Wirelessly-Powered Implantable System to Record and Modulate  
the Gastric Slow Waves in Freely-Behaving Rodents**  
09:30-09:45      Amir Javan-Khoshkholgh, Calla Dexheimer, Alexandria Shea, Morgan  
Verhaalen and Dylan Berry (University of Wisconsin - Eau Claire, USA)
- TA2A-5      Far-Field Wireless Power Transfer Efficiency Enhancement Using  
Parasitic Patch Near a Circular Polarized Receiver for IMDs**  
09:45-10:00      Alok Chandra Joshi, Jogesh Chandra Dash, Debdeep Sarkar (Indian  
Institute of Science, India)

08:30 - 10:15, Tue, May 17, 2022

Special Session: TA3A

**Research Highlights from Young Professionals in Microwaves in Biology and  
Medicine**

(organized by the MTT TC-28 young professionals subcommittee)

**Room:** Room 3

**Organizer:** Emily Porter, University of Texas at Austin, USA

**Chairs:** Emily Porter, University of Texas at Austin, USA

Tomislav Markovic, University of Zagreb, Croatia and KU Leuven, Belgium

**TA3A-1 Importance of Sex-Based Modelling of the Pelvic Region for  
Microwave Medical Applications (Invited)**

08:30-09:00 Ali Farshkaran and Emily Porter (University of Texas at Austin, USA)

**TA3A-2 Analysis of Microwave Heating Devices for Microfluidics**

09:00-09:15 Tomislav Markovic (University of Leuven, Belgium); Bart K. J. C. Nauwelaers  
(KU Leuven, Belgium)

**TA3A-3 3-D Etching Techniques for Low-Cost Wearable Microwave Devices  
in Grounded Coplanar Waveguide**

09:15-09:30 Giulia Battistini, Giacomo Paolini and Diego Masotti (University of  
Bologna, Italy); Alessandra Costanzo (DEI, University of Bologna, Italy)

**TA3A-4 Development and Translation of Microwave Ablation Antennas With  
Directional Control of Radiation Pattern**

09:30-09:45 Punit Prakash, Warren Beard, Hojjatollah Fallahi, Charan Ganta and  
Margaret Highland (Kansas State University, USA); Austin Pfannenstiel  
(Precision Microwave, Inc., USA); Jan Sebek (Kansas State University &  
Czech Technical University, USA); Damian Dupuy (Cape Cod Hospital,  
USA)

**TA3A-5 Microwave Characterization and Probe Sensing: Parametric Study  
With Skin Phantom Thickness**

09:45-10:00 Jasmine Boparai, Yanis Jallouli, Oliver Miller, Rachel Tchiov and Milica  
Popović (McGill University, Canada)

**TA3A-6 Recent Advances in Vital Signs Monitoring of Multiple Subjects Using**

## **Contactless Radar-Based Sensor**

10:00-10:15 Shekh Md Mahmudul Islam (University of Dhaka, Bangladesh & University of Hawaii, Bangladesh)

10:25 - 12:10, Tue, May 17, 2022

Session: TA1B

Emerging Sensing Technologies for Biomedical Applications

Room: Room 1

- Chairs:** Yueming Gao, Fuzhou University, China  
Shuangli Liu, Southwest University of Science and Technology, China
- TA1B-1      Theory and Applications in Biomedical Engineering After Discovering a New Human Organ "Interstitialium"**
- 10:25-10:40      Johnson J. H. Wang (Wang Electro-Opto Corporation, USA)
- TA1B-2      Equivalent Circuit Model of the Cell Stimulated by Pulsed Electric Field**
- 10:40-10:55      Xin Rao (Hangzhou Dianzi University, China); Xiaodong Chen and Yasir Alfadhl (Queen Mary University of London, United Kingdom); Liyang Yu (Hangzhou Dianzi University, China)
- TA1B-3      Application of Electrical Impedance Tomography for Monitoring Tissue Water Content of the Thigh**
- 10:55-11:10      Shuzhe Chen, Ke Zhang, Maokun Li and Yuqi Zhang (Tsinghua University, China); Yibing Wang (ICU of Tsinghua University Yuquan Hospital, China); Fan Yang and Shenheng Xu (Tsinghua University, China); Aria Abubakar (Schlumberger-Doll Research, USA)
- TA1B-4      A New Non-Invasive Cerebral Blood Flow Monitoring System Based on Inductive Sensing Technology**
- 11:10-11:25      Maoting Zhang and Jian Sun (Army Medical University, China); Jichao Yuan (Southwest Hospital, China)
- TA1B-5      A Wearable Breath Detection Device Based on Capacitive Coupling**
- 11:25-11:40      Shengtong Yin (School of Pharmacy and Bioengineering, Chongqing University of Technology, China); Gen Li (Chongqing University of Technology, China)
- TA1B-6      Grip Force Prediction Based on Changes in Brachioradialis Muscle Impedance**
- 11:40-11:55      Pan Xu, Xudong Yang and Hongli Yan (Fuzhou University, China); Željka Luč ev Vasić and Mario Cifrek (University of Zagreb, Croatia); Yueming

Gao (Fuzhou University, China)

**TA1B-7      Sensor Spatial Impulse Response Model-Based Microwave Induced  
Thermoacoustic Reconstruction**

11:55-12:10      Shuangli Liu(Southwest University of Science and Technology, China)



10:25 - 12:10, Tue, May 17, 2022

Special Session: TA2B

High Field or Low Field for MRI, What Do You Think?

Room: Room 2

**Organizers:** Shaoying Huang, Singapore University of Technology, Singapore  
John Thomas Vaughan, Columbia University, USA

**Chairs:** Shaoying Huang, Singapore University of Technology, Singapore  
John Thomas Vaughan, Columbia University, USA

**TA2B-1      A Second Generation 9.4T Neuro-Imager**

10:25-10:40 J Thomas Vaughan (Columbia University, USA); Alexandre Franco (Nathan Kline Institute, USA)

**TA2B-2      Ultra-High-Field MRI: An Approach to Precision Medicine**

10:40-10:55 Xiaotong Zhang (Zhejiang University, China)

**TA2B-3      Human Magnetic Resonance Imaging at 5 Tesla: Initial Results**

10:55-11:10 Zidong Wei (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China & United Imaging Healthcare, China); Qiaoyan Chen (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China & Key Laboratory for Magnetic Resonance and Multimodality Imaging of Guangdong Province, China); Shao Che (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China & United Imaging Healthcare, China); Fuyi Fang (Shanghai United Imaging Healthcare, China); Xiaoliang Zhang (State University of New York at Buffalo, USA); Xin Liu (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China & Key Laboratory for Magnetic Resonance and Multimodality Imaging of Guangdong Province, China); Hairong Zheng (SIAT Shenzhen, China); Ye Li (Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, China & Key Laboratory for Magnetic Resonance and Multimodality Imaging of Guangdong Province, China)

- TA2B-4**            **1.5T or 3T? From Research to Clinical Applications**  
11:10-11:25    Thu-Thao Le (National Heart Centre Singapore & Duke-NUS Medical School, Singapore)
- TA2B-5**            **Industrial NMR and MRI Using Permanent Magnet Array**  
11:25-11:40    Jie Liu (NingBo ChuanShanJia Electrical and Mechanical Co., Ltd., China);  
Bing Keong Li (Jiangsu LiCi Medical Device Co., Ltd, China); Shaoying  
Huang (Singapore University of Technology and Design, Singapore)
- TA2B-6**            **0.11T Magnet for Portable MRI (Invited)**  
11:40-11:55    Shao Ying Huang and Ting-Ou Liang (Singapore University of Technology  
and Design, Singapore)
- TA2B-7**            **High Field or Low Field for MRI, What Do You Think?**  
11:55-12:10    Panel Discussions

10:25 - 12:10, Tue, May 17, 2022

Session: TA3B

Antennas for Biomedical Applications I

Room: Room 3

- Chairs:** Lingnan Song, Beihang University, China  
Yuan Feng, National University of Singapore, Singapore
- TA3B-1**      **Combination of Wearable Axial and Planar Magneto inductive Waveguide for Low Loss WBANs**
- 10:25-10:40      Connor B. Jenkins, Vigyanshu Mishra, Asimina Kiourti (The Ohio State University, USA)
- TA3B-2**      **On the Frequency Selection Strategies for Miniaturized and Passive Neural Implants: Case Studies in PNS and Spinal Cord Recordings**
- 10:40-10:55      Sijia Fu (China University of Geoscience (Beijing), China); Lingnan Song (Beihang University, China)
- TA3B-3**      **Quasi-Isotropic Reconfigurable Antenna Through Complementary Radiation Patterns for Wireless Capsule Endoscope**
- 10:55-11:10      Xinning Li and Xiongying Liu (South China University of Technology, China)
- TA3B-5**      **A Novel Dual-Polarized On-Body Cross-Bowtie Antenna for Into-Body Data Telemetry**
- 11:10-11:25      Han Wang (National University of Singapore, Singapore); Lei Zhu (Nanjing University of Science and Technology, China); Yong-Xin Guo (National University of Singapore, Singapore)
- TA3B-6**      **Compact Four-Element MIMO Antenna With High Isolation for High-Data-Rate Telemedicines**
- 11:25-11:40      Xin Ling and Xiongying Liu (South China University of Technology, China)
- TA3B-7**      **Wide-Slot Tri-Band Patch Antenna Fed by Quarter Wave Transformer for Biomedical Applications**
- 11:40-11:55      Jun Yan Lee (Xiamen University Malaysia, Malaysia); Minqiu Zhu (Xiamen University Malaysia, China); Yang Kundong (Xiamen University Malaysia, China); Lee Yu Chen and Intan Izafina Idrus (Xiamen University Malaysia,

Malaysia)

**TA3B-8      A 94 GHz Slot Array Fed by a WR10 Interface**

11:55-12:10      Ke Huang, Xiaoli Zhi and Lixin Ran (Zhejiang University, China)

13:30 - 15:30, Tue, May 17, 2022

Special Session: TP1A

Microwave Vibration Sensing and Its Applications on Biomedical Engineering

Room: Room 1

**Organizer:** Yuyong Xiong, Shanghai Jiaotong University, China

**Chairs:** Yuyong Xiong, Shanghai Jiaotong University, China  
Feng Lin, Zhejiang University, China

**TP1A-1** **Speech Acquisition and Recovery Based on Piezoelectric Effect in the mmWave Band (Invited)**

13:30-14:00 Kaidi Zheng, Chao Wang, Zhanglei Shu and Feng Lin (Zhejiang University, China)

**TP1A-2** **Doppler Cardiogram Detection in Clinical Environment**

14:00-14:15 Shuqin Dong (Shanghai Jiao Tong University, China); Zhi Zhang (Shanghai General Hospital, China); Changzhan Gu and Junfa Mao (Shanghai Jiao Tong University, China)

**TP1A-3** **Vital Signs Monitoring via Millimeter-Wave Full-Field Micromotion Sensing**

14:15-14:30 Songxu Li, Yuyong Xiong, Xiangtian Shen Zhike Peng (Shanghai Jiaotong University, China)

**TP1A-4** **A Split-Ring Resonator-Based Planar Microwave Sensor for Microfluidic Applications**

14:30-14:45 Wei Ye, Wen-Sheng Zhao, Jing Wang, Da-Wei Wang and Gaofeng Wang (Hangzhou Dianzi University, China)

**TP1A-5** **Wideband Circularly Polarized Antenna Based on Gradual Capacitor Feeding for RFID Reader Applications**

14:45-15:00 Xiaoya Liu, Changrong Liu and Xueguan Liu (Soochow University, China)

**TP1A-6** **A Novel ST-DFnT Based Parameter Estimation for LFM Signals**

15:00-15:30 Pingping Wang, Jingqi Wang and Huan Zeng (Nanjing University of Science and Technology, China)

13:30 - 15:30, Tue, May 17, 2022

Session: TP2A

Tracking and Sensing Systems for Biomedical Applications

Room: Room 2

- Chairs:** Wen-Sheng Zhao, Hangzhou Dianzi University, China  
Yong Luo, Shanghai University, China
- TP2A-1      Design of Position Tracking System for Nasogastric Intubation (Invited)**
- 13:30-14:00      Meng-Hsuan Lin and Chia-Chan Chang (National Chung-Cheng University)
- TP2A-2      Miniaturized Microwave Microfluidic Sensor Based on Spoof Localized Surface Plasmons**
- 14:00-14:15      Hao Xu, Wen-Sheng Zhao and Da-Wei Wang (Hangzhou Dianzi University, China)
- TP2A-3      Physics-Informed Deep Learning for Time-Domain Electromagnetic Radiation Problem**
- 14:15-14:30      Ge Yingze, G. L Shuai, Maokun Li (Tsinghua University, China)
- TP2A-4      Theoretical Analysis for High-Sensitivity Sensor**
- 14:30-14:45      Gangyi Yang, Ni Dong, Yue Pei and Yong Luo (Shanghai University, China)
- TP2A-5      A Multi-Class Dataset Expansion Method for Wi-Fi-Based Fall Detection**
- 14:45-15:00      Xin Wen and Xinran Song (National University of Singapore (Suzhou) Research Institute, China); Zhi Zheng, Bo Wang and Yongxin Guo (National University of Singapore, Singapore)
- TP2A-6      A Concurrent 17/24 GHz Low-Noise Amplifier for Vital Signs Monitoring System**
- 15:00-15:15      Biaoping Huang (Nanjing University of Science and Technology, China); Guoxiao Cheng (Southeast University, China); Kang Wei and Zongxiang Wang (Nanjing University of Science and Technology, China)
- TP2A-7      PAPR Reduction Technology for ST-OCDFM Based Joint Radar-**

## **Communication Signals**

15:15-15:30 Luo Fan (Nanjing University of Science and Technology, China)

13:30 - 15:30, Tue, May 17, 2022

Special Session: TP3A

**Novel Methods and Algorithms for Electromagnetic Wave Induced Acoustic  
Biomedical Applications**

**Room:** Room 3

**Organizer:** Lin Huang, University of Electronic Science and Technology of China, China

**Chairs:** Lin Huang, University of Electronic Science and Technology of China, China  
Zihui Chi, Chongqing University of Posts and Telecommunications, China

**TP3A-1 Thermoacoustic Imaging of Liver Based on Eddy Current Loss**

13:30-13:45 Zheng Zhu (Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, China); Huang Lin (University of Electronic Science and Technology of China, China)

**TP3A-2 Realization of Two-Way Communication Across the Air-Water Interface by Thermoacoustic Effect**

13:45-14:00 Weipeng Wang, Zheng Liang, Shuaiqi Qiao, Huang Lin and Jiawei Long (University of Electronic Science and Technology of China, China); Jing Lu (Chengdu Technological University, China)

**TP3A-3 Study on Thermoacoustic Imaging Excited by Controllable Polarization Microwave**

14:00-14:15 Zheng Liang, Shuaiqi Qiao, Weipeng Wang and Jiawei Long (University of Electronic Science and Technology of China, China); Jing Lu (Chengdu Technological University, China); Huang Lin (University of Electronic Science and Technology of China, China)

**TP3A-4 Application of Electromagnetic Probe in Microwave Thermoacoustic Imaging**

14:15-14:30 Shuaiqi Qiao, Zheng Liang, Weipeng Wang and Huang Lin (University of Electronic Science and Technology of China, China)

**TP3A-5 Anti-Phase Microwave Illumination-Based Thermoacoustic Tomography for in Vivo Detection of Rheumatoid Arthritis in the Finger Joints**

14:30-14:45 Zihui Chi (Chongqing University of Posts and Telecommunications, China);



Huang Lin (University of Electronic Science and Technology of China, China); Dan Wu (Chongqing University of Posts and Telecommunications, China); Jiang Huabei (University of South Florida, USA)

**TP3A-6 Numerical Investigation of the Field Distribution in Human Brain Based on Complete Electrode Model**

14:45-15:00 Changyou Li (School of Electronics and Information Northwestern Polytechnical University, China); Jiamin Liu (Northwestern Polytechnical University, China)

**TP3A-7 Microwave Ablation Surgery Guided by Machine-Learning-Enabled Microwave-Induced Thermoacoustic Tomography**

15:00-15:15 Yifei Sun and Xiong Wang (ShanghaiTech University, China)

**TP3A-8 Experimental Results of 2-D Noninvasive Temperature Monitoring of Biological Sample by Applying Compressive Thermoacoustic Tomography**

15:15-15:30 Baosheng Wang and Xiong Wang (ShanghaiTech University, China)

15:40 - 17:40, Tue, May 17, 2022

Session: TP1B

RF Sensing Technologies for Biomedical Applications I

Room: Room 1

- Chairs:** Xiaodong Chen, Queen Mary University of London, United Kingdom  
Changrong Liu, Soochow University, China
- TP1B-1      A Terahertz Metasurface for Thin Film Biosensing (Invited)**  
15:40-16:10 Akram Alomainy and Shohreh Nourinovin (Queen Mary University of London, United Kingdom)
- TP1B-2      Improvement of UHF RFID Detection Rate in Multipath Environment Using Beam-Switching Antenna Array**  
16:10-16:25 Changrong Liu (Soochow University, China); Zixuan Huang (Imperial College London, United Kingdom (Great Britain))
- TP1B-3      Multifrequency RF Sensor for the Non-Contact Monitoring of Tissues**  
16:25-16:40 Alexiane Pasquier (Université Paris Saclay & C2N, France); Yohan Le Diraison and Stéphane Serfaty (Cergy Paris Université, France); Pierre-Yves Joubert (University of Paris Sud, France)
- TP1B-4      Microwave Exposure System on Cell Solution for Alzheimer's Disease Treatment**  
16:40-16:55 Jin Zhang and Yisong Yang (Queen Mary University of London, United Kingdom); Xin Rao (Hangzhou Dianzi University, China); Wen Dang, Yasir Alfadhl and Xiaodong Chen (Queen Mary University of London, United Kingdom)
- TP1B-5      Design Approach of a K-Band FMCW Radar for Breast Cancer Detection Using a Full System-Level EM Simulation**  
16:55-17:10 Martin Maier, Finn-Niclas Stapelfeldt, Vadim Issakov (Technische Universität Braunschweig, Germany)
- TP1B-6      Method and Implementations to Measure the Absorbed Power Density**  
17:10-17:25 Fariba Karimi (ETH Zürich & Foundation for Research on Information Technologies in Society (IT'IS), Switzerland); Sven Kuhn (IT'IS Foundation,

Switzerland); Jingtian Xi (The Foundation for Research on Information Technologies in Society (IT'IS), ETH Zurich, Switzerland); Sylvain Rebox (ZMT Zurich MedTech AG, Switzerland); Andreas Christ (Research Consultant, Brazil); Arya Fallahi (IT'IS Foundation, Switzerland); Romain Meyer (Schmid & Partner Engineering AG (SPEAG), Switzerland); Niels Kuster (IT'IS Foundation, Switzerland)

**TP1B-7      Wireless Vital-Sign Detection Based on Improved Arc-Chord Approximation Demodulation**

17:25-17:40      Qinyi Lv, Caongqi Cao and DeYun Zhou (Northwestern Polytechnical University, China)

15:40 - 17:40, Tue, May 17, 2022

Session: TP2B

Antennas for Biomedical Applications II

Room: Room 2

- Chairs:** Zengdi Bao, Beijing Institute of Technology, China  
Wenhua Gu, Nanjing University of Science and Technology, China
- TP2B-1 Impact of Array Antenna Types on Heart Rate Monitoring Radar (Invited)**
- 15:40-16:10 Oluwatosin Babarinde and Peyman PourMohammadi (KU Leuven, Belgium); Guy Vandenbosch (Katholieke Universiteit Leuven (KU Leuven), Belgium); Dominique Schreurs (KU Leuven, Belgium)
- TP2B-2 Electromagnetic Triggering With Microparticles for Application in Drug Delivery**
- 16:10-16:25 Mohammed Saad Shaikh, Robert Jones, Rostyslav Dubrovka (Queen Mary, University of London, United Kingdom)
- TP2B-3 Transparent Monopole Antenna With EBG Array for Wearable Applications**
- 16:25-16:40 Chen Fu (Nanjing University of Science and Technology, China); Yutao Yue (Institute of Deep Perception Technology, China); Wenhua Gu (Nanjing University of Science and Technology, China)
- TP2B-4 A Dual-Band Ultra-Miniaturized Scalp-Implantable Antenna for In-Body Bioelectronics**
- 16:40-16:55 Lei Zhu (Nanjing University of Science and Technology, China); Han Wang and Yong-Xin Guo (National University of Singapore, Singapore)
- TP2B-5 Solenoid Designs for Halbach-Based Portable MRI**
- 16:55-17:10 Shao Ying Huang, Meena Rajendran (Singapore University of Technology, Singapore)
- TP2B-6 Gain-Enhanced Wideband Antenna Sensor Integrated With CMOS-Based Transceiver Chip for Human Respiratory Monitoring in Telemedicine Diagnosis**

17:10-17:25 Wensong Wang, Zhongyuan Fang, Kai Tang, Xixi Wang, Zhou Shu and Yuanjing Zheng (Nanyang Technological University, Singapore)

**TP2B-7      A Conical-Beam Electronically Scanning Antenna Array With Fixed-Frequency Using Edge Loading**

17:25-17:40 Jing-Chuan Zhao, Shi-Shan Qi, Wen Wu and Da-Gang Fang (Nanjing University of Science and Technology, China)

15:40 - 17:40, Tue, May 17, 2022

Session: TP3B

Microwave Biomedical Imaging

Room: Room 3

- Chairs:** Katia Grenier, LAAS-CNRS, France  
Zhun Wei, Zhejiang University, China
- TP3B-1 On the Design of Microwave Imaging Devices for Medical Applications (Invited)**  
15:40-16:10 Lorenzo Crocco (CNR - National Research Council of Italy, Italy)
- TP3B-2 Deep Learning Based Inverse Scattering Analysis for Microwave Breast Cancer Imaging (Invited)**  
16:10-16:40 Shouhei Kidera, Umita Hirose and Peixiang Zhu (University of Electro-Communications, Japan)
- TP3B-3 Extension of Possibilities for Non-Invasive Analysis by Microwave Spectroscopy of 3D Biological Models (Invited)**  
16:40-17:10 Katia Grenier (Laboratory of Analysis and Architecture of Systems (LAAS-CNRS), France); David Dubuc (Laboratory of Analysis and Architecture of Systems (LAAS-CNRS) - University of Toulouse III, France); Olivia Peytral-Rieu (LAAS-CNRS, France)
- TP3B-4 Complementary Ensemble Empirical Mode Decomposition Based Microwave Induced Thermoacoustic Image Reconstruction Method**  
17:10-17:25 Xin Shang (China)
- TP3B-5 Machine-Learning-Based Microwave-Induced Thermoacoustic Tomography Considering Properties of Transducers**  
17:25-17:40 Lejia Zhang and Xiong Wang (ShanghaiTech University, China)

08:30 – 10:00, Wed, May 18, 2022

Session: WA1A

Radar and Communications for Life Activity Sensing

Room: Room 1

- Chairs:** Fu-Kang Wang, National Sun Yat-Sen University  
Changzhan Gu, Shanghai Jiaotong University
- WA1A-1 Self-Injection-Locked (SIL) Radars Using Frequency Modulation (FM) Techniques for Concurrent Range and Vital Sign Monitoring (Invited)**  
08:30-09:00 Fu-Kang Wang, Jixun Zhong (National Sun Yat-Sen University)
- WA1A-2 A Subcarrier Selection Method for Wi-Fi-Based Respiration Monitoring Using IEEE 802.11ac/Ax Protocols**  
09:00-09:15 Ruilin Wang and Xiaolin Zhou (Harbin Institute of Technology, Shenzhen, China); Bo Wang, Zhi Zheng and Yongxin Guo (National University of Singapore, Singapore)
- WA1A-3 Non-Contact Vital Sign Monitoring With a Metamaterial Surface**  
09:15-09:30 Dat T. Nguyen (National University of Singapore, Singapore); Qihang Zeng and Xi Tian (NUS, Singapore); John Ho (National University of Singapore, Singapore)
- WA1A-4 A Compact Non-Contact Heart Sound Sensor Based on Millimeter-Wave Radar**  
09:30-09:45 Li Wen, Shuqin Dong, Changzhan Gu and Junfa Mao (Shanghai Jiao Tong University, China)
- WA1A-5 Contactless Respiration Monitoring During Sleep With a Pair of Wi-Fi Devices**  
09:45-10:00 Hongyang Zhuo and Qinghua Zhong (University of South China Normal, China)

08:30 – 10:00, Wed, May 18, 2022

Session: WA2A

Body-Centric Communications and IoTs for Biomedical Applications

Room: Room 2

- Chairs:** Shaoqiu Xiao, Sun Yat-Sen University, China  
Xiongying Liu, South China University of Technology, China
- WA2A-1** **An Investigation on the Influence of Blood Volume in the Cardiac Cycle on Channel Gain of Intracardiac Communication Channels (Invited)**  
08:30-09:00 Yiming Liu, Yueming Gao and Liting Chen (Fuzhou University, China); Zhizhang (David) Chen (Dalhousie University, Canada); Sio-Hang Pun (University Of Macau, Macao); Mang I Vai (University of Macau, China)
- WA2A-2** **Wearable Dual-Band Filtering Monopole Antenna for Wireless Body-Centric Communications**  
09:00-09:15 Qun Li (Sun Yat-Sen University, China); Shaoqiu Xiao (Sun Yat-Sen University, China)
- WA2A-3** **Finite Element Modeling and Experimental Analysis of Bladder Volume Body Surface Monitoring Method**  
09:15-09:30 Hongli Yan, Xudong Yang, Xu Li and Yueming Gao (Fuzhou University, China); Željka Luč ev Vasić and Mario Cifrek (University of Zagreb, Croatia)
- WA2A-4** **Dual-Mode Implantable Antenna With Dual Bands for Omnidirectionally In-Body and Circularly Polarized Off-Body Communications**  
09:30-09:45 Jie Hong (South China University of Technology, China); Yi Fan (Gongdong Polytechnic Normal University, China); Xiongying Liu (South China University of Technology, China)
- WA2A-5** **Rehabilitation Training System for Upper Limbs of Frail Elderly People**  
09:45-10:00 Hongping Guo (Shanghai University, China); Zhihua Yu and Chuan Chen (Shanghai University of Traditional Chinese Medicine, China); Jiehui Jiang (Shanghai University, China)



08:30 – 10:00, Wed, May 18, 2022

Session: WA3A

Wearable and Bio-Implantable Wireless Devices

Room: Room 3

- Chairs:** Wenyao Xu, SUNY Buffalo & Wireless Health Institute, USA  
Chaofeng Ye, Shanghaitech University, China
- WA3A-1**     **mmWave and AI Techniques for Voice Biometric Computing (Invited)**  
08:30-09:00   Wenyao Xu (SUNY Buffalo & Wireless Health Institute, USA)
- WA3A-2**     **A Miniaturized Optically Pumped Atomic Magnetometer for Wearable Magnetoencephalography (Invited)**  
09:00-09:30   Yaqiong Niu, Zhicheng Zou, Yutong Wei, Sitong Chen, Chaofeng Ye (ShanghaiTech University, China)
- WA3A-3**     **On-Chip Analysis of Gastric Slow Waves: Toward a Closed-Loop System for Managing Gastrointestinal Disorders**  
09:30-09:45   Amir Javan-Khoshkholgh (University of Wisconsin - Eau Claire, USA); Aydin Farajidavar (USA); Wahib Alrofati and Joseph Sassoon (New York Institute of Technology, USA)
- WA3A-4**     **Geomagnetic Field Counteraction for Wireless Capsule Endoscope Tracking**  
09:45-10:00   Yuming Fu, Yong-Xin Guo (National University of Singapore, Singapore)

13:30 - 15:30, Wed, May 18, 2022

Session: WP1A

RF Sensing Technologies for Biomedical Applications II

Room: Room 1

- Chairs:** Yuanjing Zheng, Nanyang Technological University, Singapore  
Hui Chu, Nanjing University of Science and Technology, China
- WP3A-1      **Wearable Wireless Biomedical Sensors Realized Through Additive Manufacturing (Invited)****
- 13:30-14:00      Atif Shamim (King Abdullah University of Science and Technology, Saudi Arabia)
- WP1A-2      **Kirigami Strain Sensors Using Conductive Trace and Radio Frequency Estimation (Invited)****
- 14:00-14:30      Hongliang Ren (NUS, Singapore)
- WP1A-3      **EIM Multi-Frequency Measurement System Based on Virtual Instrument****
- 14:30-14:45      Xianghong Zhang, Pan Xu, Ziliang Wei and Yueming Gao (Fuzhou University, China); Željka Luč ev Vasić and Mario Cifrek (University of Zagreb, Croatia)
- WP1A-4      **Asymmetric Transmission in Tunable Spoof Plasmonic Meta-Waveguide and Its Applications in High-Efficiency Biological Temperature Sensing and Imaging****
- 14:45-15:00      Xixi Wang (Nanyang Technological University, Singapore); Yu Luo and Yuanjing Zheng (Nanyang Technological University, Singapore)
- WP1A-5      **Non-Invasive Tremor Sensor****
- 15:00-15:15      Santosh Bejugam (GITAM University, India); Jyothi Vankara (GITAM Deemed to be University, India)

13:30 - 15:30, Wed, May 18, 2022

Special Session: WP2A

Sensing and Imaging based on Acoustics, Metamaterials and Metasurfaces

Room: Room 2

**Organizers:** Yong Jin Zhou, Shanghai University, China  
Weiren Zhu, Shanghai Jiaotong University, China

**Chairs:** Yong Jin Zhou, Shanghai University, China  
Xuanru Zhang, Southeast University, China

**WP2A-1      Enhanced Thermoacoustic Imaging Using Split Ring Topologies  
(Invited)**

13:30-14:00    Lei Xi (Southern University of Science and Technology, China)

**WP2A-2      Spoof Localized Surface Plasmons for Microwave Sensing**

14:00-14:15    Xuanru Zhang and Tie Jun Cui (Southeast University, China)

**WP2A-3      Mu-Near-Zero Medium Sensor for Measuring Microwave Absorbing  
Material**

14:15-14:30    Yu Wei Mao (Shanghai University, China); Tao ZHOU (Hangzhou Dianzi  
University, China); Yong Jin Zhou (Shanghai University, China)

**WP2A-4      Water Antenna Based Passive Wireless Temperature Sensor**

14:30-14:45    Ting Shuang Zheng and Hong Xin Xu (Shanghai University, China); Tao  
ZHOU (Hangzhou Dianzi University, China); Yong Jin Zhou (Shanghai  
University, China)

**WP2A-5      An Improved RF Sensor to Determine Solute Concentration Level in  
Simulated Body Fluids**

14:45-15:00    Apala Banerjee (Indian Institute of Technology, India); Shubhadip Paul and  
Nilesh Tiwari (IIT Kanpur, India)

**WP2A-6      A Comprehensive Analysis of Passive Programmable Metasurface  
Imager Based on Ambient Signals**

15:00-15:15    Ya Shuang (East China Normal University, China)

**WP2A-7      Dual-Band Transmission Surfaces With Small Frequency Ratio and  
Sharp Skirt Frequency Response**

15:15-15:30 Bing Wang, Wen Wu, Zhi-Yuan Zong and Da-Gang Fang (Nanjing University of Science and Technology, China)

13:30 - 15:30, Wed, May 18, 2022

Session: WP3A

Antennas and Circuits

Room: Room 3

- Chairs:** Jianpeng Wang, Nanjing University of Science and Technology, China  
Jian-Xin Chen, Nantong University, China
- WP3A-1      A Compact Dual-Band Microstrip Patch Antenna for 5G Applications**
- 13:30-13:45      Qian Xu, Jingchen Wang, Mark Leach and Eng Gee Lim (Xi'an Jiaotong-Liverpool University, China); Zhao Wang (Xi'an Jiaotong Liverpool University & University of Liverpool, China); Rui Pei (Donghua University, China); Zhenzhen Jiang (Xi'an Jiaotong-Liverpool University & University of Liverpool, China)
- WP3A-2      A Compact Monolithic Dielectric Dual-Polarized Magneto-Electric Dipole Antenna**
- 13:45-14:00      Yanyuan Zhu, Jianpeng Wang (Nanjing University of Science and Technology, China); Jian-Xin Chen (Nantong University, China); Wen Wu (Nanjing University of Science and Technology, China)
- WP3A-3      A Wideband 77-GHz Power Amplifier With Mixed Matching Network in 130-nm BiCMOS Technology**
- 14:00-14:15      Xicheng Zhu, Tongde Huang and Wen Wu (Nanjing University of Science and Technology, China)
- WP3A-4      CMOS Front-End Integrated Circuits With Antenna for Dual-Conversion Receiver Applications**
- 14:15-14:30      Wen Cheng Lai (National Taiwan University of Science and Technology)

15:40 - 17:40, Wed, May 18 2022

Special Session: WP1B

Ultra Low-Power IoT Systems for Biomedical Applications

Room: Room 1

**Organizers:** Thomas Ussmueller, University of Innsbruck, Austria  
Jasmin Walk, University of Innsbruck, Austria

**Chairs:** Thomas Ussmueller, University of Innsbruck, Austria  
Jasmin Walk, University of Innsbruck, Austria

**WP1B-1 An e2e Communication System Operating in the Electromagnetic Near Field (Invited)**

15:40-16:10 Jasmin Walk (University of Innsbruck & Friedrich-Alexander University Erlangen-Nuernberg, Austria); Jan-Christoph Edelmann and Thomas Ussmueller (Universität Innsbruck, Austria)

**WP2B-2 Fault Detection of Microwave Components Using Direct Display Field Representation Microwave Thermography (Invited)**

16:10-16:40 Christoph Baer (Ruhr-Universität Bochum & Institute of Electronic Circuits, Germany)

**WP1B-3 Battery-Less ECG Embedded in Smart Textiles**

16:40-16:55 Jasmin Walk (University of Innsbruck & Friedrich-Alexander University Erlangen-Nuernberg, Austria); Thomas Ussmueller (Universität Innsbruck, Austria)

**WP1B-4 Bracelet Textile Electrodes for Bioimpedance Measurements**

16:55-17:10 Giuseppina Monti and Emanuele Paiano (University of Salento, Italy); Federica Raheli (Italy); Luciano Tarricone (University of Salento, Italy)

**WP1B-5 IoT Wearable EH System Based on Wrist Motion Kinetic Energy Harvesting**

17:10-17:25 Raffaele Salvati, Valentina Palazzi and Luca Roselli (University of Perugia, Italy)

15:40 - 17:40, Wed, May 18, 2022

Special Session: WP2B

**Microwave-Induced Thermoacoustic Imaging and Its Basic Research of Medical Application**

**Room:** Room 2

**Organizer:** Huan Qin, South China Normal University, China

**Chairs:** Huan Qin, South China Normal University, China  
Yujiao Shi, South China Normal University, China

**WP2B-1 Handheld Microwave Thermoacoustic Imaging**

15:40-15:55 Linghua Wu (South China Normal University, China)

**WP2B-2 Controllable Synthesis of pH-Sensitive Carbon Dioxide-Based Functional Probe and Its Application for Photoacoustic Imaging**

15:55-16:10 Guojia Huang (Guangdong Provincial People's Hospital, Guangdong Academy of Medical Sciences, China)

**WP2B-3 Vacancy-Defect-Dipole Amplifies the Thermoacoustic Conversion Efficiency of Two-Dimensional Nanomaterials**

16:10-16:25 Xiaoye Su (South China Normal University, China)

**WP2B-4 Polarized Photoacoustic Microscopy**

16:25-16:40 Zhenhui Zhang (South China Normal University, China)

**WP2B-5 Evaluating Performance of Artifact Removal by Fully Dense U-Net for Microwave Induced Thermoacoustic Tomography**

16:40-16:55 Jian Song, Tao Shen and Qingwang Wang (Kunming University of Science and Technology, China)

**WP2B-6 Microwave Thermoacoustic, Photoacoustic and Ultrasonic Tri-Modal Volumetric Imaging**

16:55-17:10 Zhongwen Cheng (Guangdong University of Technology, China)

**WP2B-7 Manganous-Manganic Oxide Nanoparticle as an Activatable Microwave-Induced Thermoacoustic Probe for Deep-Located Tumor Specific Imaging in Vivo**

17:10-17:25 Shanxiang Zhang (South China Normal University, China)

**WP2B-8      Imaging-Guided      Microwave      Thermo-Chemotherapy      of  
Hepatocellular Carcinoma**

17:25-17:40      Liewei Wen (Zhuhai People's Hospital, Zhuhai Hospital Affiliated with  
Jinan University, China)



15:40 - 17:40, Wed, May 18, 2022

**Special Session: WP3B**

**Machine Learning in Biomedical Imaging Algorithms**

**Room:** Room 3

**Organizers:** Maokun Li, Tsinghua University, China  
Rui Guo, Tsinghua University, China

**Chairs:** Maokun Li, Tsinghua University, China  
Rui Guo, Tsinghua University, China

**WP3B-1 Machine Learning for Bioelectromagnetics and Biomedical Engineering: Some Sample Applications (Invited)**

15:40-16:10 Luciano Tarricone, Alfredo De Cillis and Marco Zappatore (University of Salento, Italy)

**WP3B-2 Physics Embedded Deep Neural Network for Microwave Imaging**

16:10-16:25 Rui Guo, Zhichao Lin, Maokun Li, Fan Yang and Shenheng Xu (Tsinghua University, China); Aria Abubakar (Schlumberger-Doll Research, USA)

**WP3B-3 Foreign Matter Detection System in Human Tissue Based on Inverse Scattering Approach**

16:25-16:40 Naïke Du and Xiuzhu Ye (Beijing Institute of Technology, China)

**WP3B-4 A Three-Dimensional Phantom for Evaluating the Performance of Electrical Impedance Tomography System**

16:40-16:55 Wenyong Li (China); Maokun Li, Fan Yang, Shenheng Xu and Ke Zhang (Tsinghua University, China)

**WP3B-5 Experimental Results of Transcranial Brain Hemorrhage Detection Applying Machine-Learning-Enabled Microwave-Induced Thermoacoustic Tomography**

16:55-17:10 Chenzhe Li and Xiong Wang (ShanghaiTech University, China)

**WP3B-6 Deep-Learning-Based Microwave-Induced Thermoacoustic Tomography Using Sparse Data**

17:10-17:25 Chenzhe Li and Xiong Wang (ShanghaiTech University, China)

**WP3B-7 Focused Microwave Breast Hyperthermia Monitored by Machine-**

**Learning-Enabled Microwave-Induced Thermoacoustic Tomography**

17:25-17:40 Xiong Wang and Dantong Liu (ShanghaiTech University, China)