Dr. AYACHE BOUAKAZ
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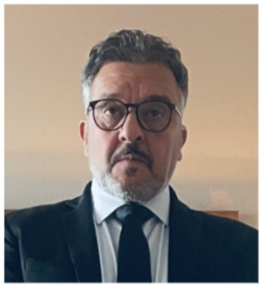

Short biography:

Dr. Ayache Bouakaz obtained his Master degree and his PhD in acoustics in 1992 and 1996 at the National Institute of Applied Sciences in Lyon, France (INSA Lyon). In 1998, he joined the Pennsylvania State University at State College, PA, USA as a Research Fellow. From December 1999 to November 2004, he held a Senior Research Associate position at Erasmus Medical Center in Rotterdam, the Netherlands. His research focused on ultrasound imaging, ultrasound contrast agents and transducer design.
In 2004, he obtained a position as an Inserm researcher and since 2009, he has held the position of research director in the Inserm Imaging and Brain institute (iBrain) where he heads the Team “Morphofunctional imaging and therapeutic ultrasound”. His research focuses on microbubble and ultrasound for drug delivery, ultrasound-based brain stimulation, and high-frequency skin imaging using elastography and photoacoustics.
Ayache Bouakaz was a "chair professor" at the Jiaotong University of Xi'an in China (2017-2022).
He is the general chair of the international conference IEEE International Ultrasonics Symposium (IEEE IUS) 2016 in Tours, France and co-general chair of the IEEE IUS 2021, in Xi’an China (virtual meeting). He has served as the vice-president of the IEEE UFFC society in charge of Symposia from 2017-2020 and an elected board member of the International Therapeutic Ultrasound society (2017 –2019).
He has been awarded the distinguished lecturer award of the IEEE UFFC society 2023-2024. He has published more than 220 articles in peer-reviewed journals, more than 100 articles published in conference proceedings and has filed 9 patents.

Keynote title:
Therapeutic ultrasound and the brain: Engineering challenges and clinical opportunities

Keynote abstract:

Therapeutic ultrasound (TUS) is a promising noninvasive technique for treating brain disorders. It can precisely target deep brain structures without surgery or implants and is being applied in clinical trials and approved treatments for conditions such as essential tremor, Parkinson’s disease, Alzheimer’s disease, glioblastoma, and depression. TUS can achieve different effects depending on the energy applied, including thermal ablation, neuromodulation, and opening of the blood-brain barrier (BBB) for drug delivery.
This presentation reviews the main physical mechanisms involved in therapeutic ultrasound, including thermal effects and mechanical actions such as microbubble cavitation. It also discusses the system architectures that allow for precise control of these effects. Examples include multi-element phased arrays guided by MRI or neuronavigation, wearable devices, and acoustic lenses and holograms. These systems require accurate beamforming, electronic steering, and integration with imaging or neural monitoring tools. A major engineering challenge is the skull, which distorts and attenuates ultrasound waves. Several methods have been developed to address this, including Computed Tomography based aberration correction, 3D-printed acoustic lenses, and numerical simulations of wave propagation. These

solutions rely on principles from control theory and signal processing to improve targeting accuracy and safety. In particular, they involve inverse problem solving, model predictive control, real-time adaptive beamforming, and spatiotemporal signal reconstruction. These are all areas where expertise in dynamic system modeling, feedback regulation, and filtering algorithms can play a transformative role in advancing therapeutic ultrasound technologies. The talk will highlight how electronics, control, and communication technologies play a key role in advancing therapeutic ultrasound as a precise and flexible platform for brain therapy.