Panel on Assessment of Electromagnetic Spectrum Sciences

Committee

Mahta Moghaddam

Chair

MAHTA MOGHADDAM (NAE) is distinguished professor and Ming Hsieh Chair in Electrical and Computer Engineering at the University of Southern California (USC) and Vice Dean for Research at the Viterbi School of Engineering. Previously, she was at the University of Michigan (2003-2011) and NASA JPL (1991-2003). Dr. Moghaddam's research interests are in variety of topics related to applied electromagnetics, including the development of advanced radar systems for environmental sensing and subsurface characterization, software-defined radar, mixed-mode high-resolution medical imaging techniques, and autonomous sensor webs for remote sensing data collection and validation. Each of these areas requires the development of state-of-the-art sensors as well as novel signal processing and physical models to characterize the sensors and their interaction with their intended environments. Her recent research includes the development of new radar technologies for subsurface and subcanopy characterization, forward and inverse scattering techniques for layered random media especially for water resource characterization, geophysical retrievals using signal-of-opportunity reflectometry, and transforming concepts of radar to medical imaging and therapy systems. She has led numerous multi-disciplinary projects in these areas and has been a member of the science teams of several NASA missions. She has expertise in microwave sensing across the spectrum for environmental and biomedical applications. She was Systems Engineer for the Cassini Radar and served as Science Chair of the JPL Team X (Advanced Mission Studies Team). She is on the Science Teams of the NASA CYGNSS mission and the Arctic Boreal Vulnerability Experiment (ABoVE). She was the PI of the AirMOSS NASA Earth Ventures 1 mission. Dr. Moghaddam is a member of the National Academy of Engineering. She received a B.S. degree from the University of Kansas with highest distinction, and M.S. and Ph.D. degrees in electrical and computer engineering from the University of Illinois Urbana-Champaign.

Srabanti Chowdhury

Member

SRABANTI CHOWDHURY is the Willard and Inez Kerr Bell Faculty Scholar associate professor of Electrical Engineering (EE) at Stanford and Materials Science and Engineering (by courtesy). She is a senior fellow at the Precourt Institute of Energy at Stanford. Her research focuses on wideband gap (WBG) and ultra-wide bandgap (UWBG) materials and device engineering for energy-efficient and compact system architecture for power electronics, and RF applications. Besides Gallium Nitride, her group is exploring Diamond for various active, and passive electronic applications, particularly thermal management. She received several early career awards including DARPA Young Faculty Award, NSF CAREER, and AFOSR Young Investigator Program (YIP) in 2015. In 2016 she received the Young Scientist Award at the International Symposium on Compound Semiconductors (ISCS) and the Alfred P. Sloan fellowship in Physics in 2020. She is a senior member of IEEE and alumnus of NAE Frontiers of Engineering. To date, her work has produced over 6 book chapters, 100 journal papers, 110 conference presentations, and 26 issued patents. She serves the program committee of several IEEE conferences including IRPS and VLSI Symposium, and the executive committee of IEDM. She received her M.S and Ph.D. in electrical engineering from University of California, Santa Barbara.

Bruce Gnade

Member

BRUCE GNADE is the Chief Scientist at Mustang Optics, LLC, and Professor Emeritus at University of Texas at Dallas (UT Dallas). His research interests focus on flexible electronics, and nanostructured devices and materials for electronic applications. Previously, he was the Executive Director of the Hart Center for Engineering Leadership in the Lyle School of Engineering at SMU from 2017-2022. He was the Vice President for Research and the Distinguished Chair in Microelectronics at UT Dallas from 2006-2016. He was a program manager in the Microsystems Technology Office at the Defense Advanced Research Projects Agency (DARPA) from 1996-1999. During his 14 years at Texas Instruments he led several research and technology groups from 1982-1996. He is a Fellow of APS, IEEE, and National Academy of Inventors, and is Chair of the Board of Directors of Oak Ridge Associated Universities. He was awarded the 2021 IEEE J.J. Ebers award. He received his B.A. in chemistry from St. Louis University in 1976 and his Ph.D. in nuclear chemistry from the Georgia Institute of Technology in 1982.

Sarath Gunapala

Member

SARATH GUNAPALA is a Fellow, Senior Research Scientist, and Principal member of the engineering staff at NASA's Jet Propulsion Laboratory. His research interests range from compound semiconductor heterostructure optoelectronic devices to remote-sensing observational instruments. He has carried out extensive work in heterostructure devices for infrared detector applications. Dr. Sarath and his group pioneered the High Operating Temperature (HOT) superlattice Barrier Infrared Detector (BIRD) technology, which is a key breakthrough in infrared photodetectors. His current interest is to reduce the Size, Weight, and Power (SWaP) factor of Earth observational instruments based on HOT focal plane array subsystems to enable low-cost SmallSat and SmallSat constellations. Previously, Dr. Gunapala worked on opto-electronic devices at Bell Communication Research and AT&T Bell Laboratories in Murray Hill, New Jersey. He has received numerous awards including the NASA Outstanding Leadership Medal; NASA Exceptional Engineering Achievement Medal; SPIE George Goddard Award; Military Sensing Symposia (MSS) Levinstein Award; MSS Herschel Award; NASA Space Act Award for Exceptional Performance; Career Achievement Award from U.S. Army/RDECOM/CERDEC; IEEE Distinguished Lecturer Award; IEEE Aron Kressel Award and was inducted to the United States Space Technology Hall of Fame 2001. In 2011, he received the NASA Jet Propulsion Laboratory's Magellan Award for his leadership in the development of technology for high-performance infrared focal planes for space exploration. He is a Fellow of IEEE, Optica, and SPIE. Dr. Sarath has authored over 380 publications and 14 book chapters; given over 300 presentations including more than 80 invited talks; and holds 27 U.S. patents. He received a first-class Honors B.Sc. in physics from the University of Colombo, Sri Lanka, and an M.S. and Ph.D. in solid-state physics from the University of Pittsburgh.

Ali C. Gurbuz

Member

ALI CAFER GURBUZ is Co-director of the Information and Processing and Sensing (IMPRESS) laboratory and Assistant Professor at Mississippi State University, Department of Electrical and Computer Engineering. His research focuses on signal processing, sensing, and machine learning areas, with emphasis on compressive sensing theory and applications, computational imaging, radar and sensor array signal processing, and machine learning for radar and remote sensing. He received the NSF CAREER Award in 2021 and he is a Senior member of IEEE. He has served as an associate editor for several journals such as Digital Signal Processing, EURASIP Journal on Advances in Signal Processing and Physical Communications. He received a B.S. degree from Bilkent University, Ankara, Turkey in electrical engineering, and M.S. and Ph.D. degrees from Georgia Institute of Technology both in electrical and computer engineering.

Alan J. Michaels

Member

ALAN J. MICHAELS is a Professor in the Bradley Department of Electrical and Computer Engineering at Virginia Tech (VT) with an affiliate appointment in Mathematics at the VT National Security Institute (NSI). Dr. Michaels serves as the Director for the Spectrum Dominance Division of the NSI. He also serves as the Associate Director for Research of the Commonwealth Cyber Initiative's (CCI) Southwest Node and as VT's site director for Vertically Integrated Projects. Prior to joining VT, Dr. Michaels spent a decade at the Harris Corporation in roles ranging from national security research in secure communications, SIGINT, cryptography, and serving as functional manager for >100 engineers. Dr. Michaels earned his B.S., M.S., Ph.D. in electrical and computer engineering, a B.S. and M.S. in applied mathematics, and an M.S. in operations research from Georgia Tech as well as an M.B.A. from Carnegie Mellon.

Eric Mokole

Member

ERIC LOUIS MOKOLE is Retired from MITRE Corporation where he was an Electromagnetic Consultant in the Radar Division. He also served as Acting Division Superintendent, Branch Head, and Principal Investigator at the Naval Research Laboratory for over 29 years and Electromagnetic Warfare analysis for almost three years in the Naval Intelligence Support Center. In these roles he conducted, lead, and/or guided radar-related R&D and system analyses for existing/proposed US Navy radars on spaceborne, airborne, shipboard, expeditionary-based, and ultrawideband platforms. Dr. Mokole also co-founded and promoted Waveform Diversity R&D (included RF spectrum) and developed associated long-term R&D programs. He has assessed spectrum impacts for DoD RSTWG, NOAA RFIMS, and DoD AMBIT efforts and has analyzed electromagnetic warfare systems. He was previously a member and chair of NATO's Sensors and Electronics Technology Panel. He has published 95+ conference/journal articles, book chapters, reports; co-edited/co-authored 5 books; presented over 150 talks/tutorials; chaired/served on organizing committees of numerous conferences. He is a Sigma Xi, Life Fellow IEEE (AP-S AdCom, AES-S Radar Systems Panel Vice Chair), Fellow of the Military Sensing Symposia, Founding Member Tri-Service Waveform Diversity Working Group; part of the AMEREM/EUROEM High-Power Electromagnetics Committee, URSI Senior Member; member of the US SECDEF Office's Radar Spectrum and Technology Working Group (RSTWG); USNC-URSI government liaison, commission chair, vice chair and secretary. He has a B.S. in applied mathematics from New York University, an M.S. in mathematics from the Northern Illinois University, an M.S. in physics, an M.S. in applied mathematics, and a Ph.D. mathematics from Georgia Tech. He also has graduate and continuing ed courses in electrical engineering from George Washington University.

Nai Phuan Ong

Member

NAI PHUAN ONG currently holds the chair of Eugene Higgins Professor of Physics at Princeton University (2003 to present). He previously served as director of Princeton Center for Complex Materials from 2008 to 2014. Dr. Ong has published over 300 papers in the subfields of cuprate high-Tc superconductivity, topological insulators, chiral anomaly in Dirac/Weyl semimetals, topological superconductivity, quantum spin liquids, quantum magnetism, thermoelectric materials, torque magnetometry on cuprates, sliding conductivity in charge density wave materials, thermal Hall effect in insulators and metals, Nernst effect in metals and superconductors, the Berry curvature in quantum materials, and the anomalous Hall effect. Dr. Ong is a member of the National Academy of the Sciences, the American Academy of Arts and Sciences, a fellow of the American Association for the Advancement of Sciences, and fellow of the American Physical Society. He shared the Kamerlingh Onnes Prize (with Takagi and Uchida) for research on cuprate superconductivity in 2006 and has been included in the Thomas Reuters list of “Highly Cited Researcher” since 2014. Dr. Ong earned a B.A. from Columbis College and obtained his Ph.D. in physics from the University of California, Berkeley.

David A. Smith

Member

Dr. David R. Smith is currently the James B. Duke Distinguished Professor of Electrical and Computer Engineering Department at Duke University and Director of the Center for Metamaterial and Integrated Plasmonics. He also holds the positions of Adjunct Associate Professor in the Physics Department at the University of California, San Diego, and Visiting Professor of Physics at Imperial College, London. Dr. Smith's research interests include the theory, simulation and characterization of unique electromagnetic structures, including photonic crystals and metamaterials. Dr. Smith is best known for his theoretical and experimental work on electromagnetic metamaterials. Dr. Smith has been at the forefront in the development of numerical methods to design and characterize metamaterials, and has also provided many of the key experiments that have helped to illustrate the potential that metamaterials offer. Dr. Smith and his colleagues at UCSD demonstrated the first left-handed (or negative index) metamaterial at microwave frequencies in 2000--a material that had been predicted theoretically more than thirty years prior by Russian physicist Victor Veselago. No naturally occurring material or compound with a negative index-of-refraction had ever been reported until this experiment. In 2001, Dr. Smith and colleagues followed up with a second experiment confirming one of Veselago's key conjectures: the 'reversal' of Snell's law. These two papers--the first published in Physical Review Letters and the second in Science--generated enormous interest throughout the community in the possibility of metamaterials to extend and augment the properties of conventional materials. Both papers have now been cited nearly 2,000 times each. Since those first metamaterial experiments, Dr. Smith has continued to study the fundamentals and potential applications of negative index media and metamaterials. In 2004, Dr. Smith began studying the potential of metamaterials as a means to produce novel gradient index media. By varying the index-of-refraction throughout a material, an entire class of optical elements (such as lenses) can be formed. Dr. Smith showed that metamaterials could access a much larger range of design space, since both the magnetic and the electric properties could be graded independently. Dr. Smith and colleagues demonstrated several versions of gradient index optics, an activity that continues in his lab today. The introduction of controlled spatial gradients in the electromagnetic properties of a metamaterial flows naturally into the broad concept of transformation optics - a new electromagnetic design approach proposed by Sir John Pendry in 2006. To illustrate of the novelty of this design approach, Pendry, Schurig and Dr. Smith suggested in 2006 that an 'invisibility cloak' could be realized by a metamaterial implementation of a transformation optical design. Later that same year, Dr. Smith's group at Duke University reported the demonstration of a transformation optical designed 'invisibility cloak' at microwave frequencies. The concept of transformation optics has since attracted the attention of the scientific community, and is now a rapidly emerging sub-discipline in the field. In 2002, Dr. Smith was elected a member of The Electromagnetics Academy. Dr. Smith has more than twenty patent disclosures, with four issued patents relating to plasmonics and metamaterials. Dr. Smith received his Ph.D. in 1994 in Physics from the University of California, San Diego (UCSD).

Rod Waterhouse

Member

ROD WATERHOUSE is Chief Technology Officer at Octane Wireless an antenna and high-performance RF-over-fiber technologies company. His research and product development interests include antennas, electromagnetics, and microwave photonics engineering. In 1994 he joined RMIT University as a lecturer, became a Senior Lecturer in 1997, and an Associate Professor in 2002. From 2001 – 2003 Dr Waterhouse was with the venture-backed Dorsal Networks which was later acquired by Corvis Corporation. From 2003 he was also appointed as an honorary Senior Fellow within the Department of Electrical and Electronic Engineering at the University of Melbourne. He has over 300 publications in these fields, including 2 books and 4 book chapters, and has helped develop hundreds of products related to these technologies. Dr. Waterhouse is a Fellow of the IEEE. He received his BEng, MS, and Ph.D. in electrical engineering from the University of Queensland, Australia, in 1987, 1989, and 1994, respectively.