Guest Editorial

OVER THE past few years, we have witnessed rapid advances in the general field of microwave technology, including numerical electromagnetic methods, device and components technology, and antenna systems. These advances have led to the availability of an array of technologies for biomedical applications that were not at our disposal just a few years ago.

This TRANSACTIONS' "Special Issue on Medical Applications and Biological Effects of RF/Microwaves" is devoted to the latest research in RF/microwaves as applied to medical and biological problems. Relevant topics include novel microwave imaging methods and systems, implantable devices, numerical methods, and computational and experimental calculations of the electromagnetic-field absorption in the human body due to various medical or wireless devices, such as magnetic resonance imaging (MRI), hyperthermia, or cellular telephones.

We are excited to have the opportunity to provide, in this TRANSACTIONS' Special Issue, a sampling of the research progress in the field of medical applications and biological effects of RF/microwaves. While not inclusive of all research in this field, we feel that this TRANSACTIONS' Special Issue provides a good general idea of the latest advances and applications, while cutting across boundaries between numerous areas tied together by the naturally interdisciplinary nature of medical applications of microwaves.

The papers in this TRANSACTIONS' Special Issue can be clustered into four major groups. The first group includes papers with a focus on microwave imaging using numerical or experimental demonstrations of the various methods. Microwave active imaging of breast cancer, radiometry, and stochastic optimization methods are included in this group.

The second group of papers includes papers with application to medical implants. This includes implantable antennas for telemetry applications and numerical methods for the design of implantable radiating devices.

The third group includes papers with applications to medical devices, including MRI and hyperthermia applications. Specifically, specific absorption rate (SAR) and heat distributions due to medical devices are of interest.

Finally, the fourth group of papers deals with electromagnetic interaction and safety assessment of electromagnetic fields. These papers include numerical and experimental techniques, as well as methods for faster determination of the SAR.

It is our hope that readers find the research results presented in this TRANSACTIONS' Special Issue exciting. We cannot help but think that given the highly sophisticated techniques that are being developed, the medical applications of RF/microwaves will continue to blossom for years to come. We are sure that the IEEE Microwave Theory and Techniques Society (IEEE MTT-S) community will continue to make excellent contributions to this field.

Lastly, we would like to express our sincere thanks to the peer reviewers for this TRANSACTIONS' Special Issue listed below. Most of them participated in two or three rounds of reviews for each paper. They have dedicated their precious time to ensure that this TRANSACTIONS' Special Issue contains high-quality manuscripts, and for that, we are extremely grateful. Last but not least, we would like to thank the Editor-in-Chief, Prof. Michael B. Steer, North Carolina State University, Raleigh, for providing valuable assistance during various phases of this project. Without his help, it would have been extremely difficult to manage this task.

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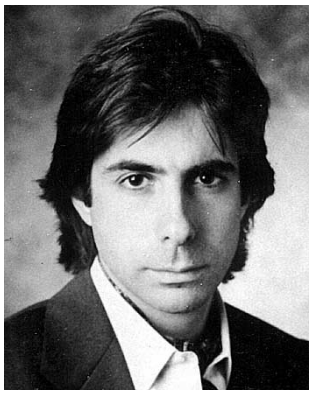
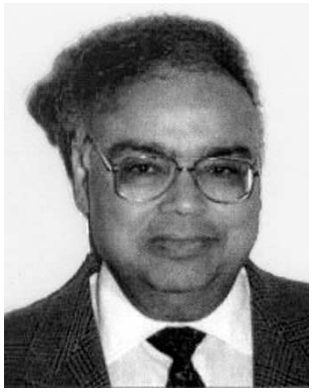


Gianluca Lazzi (S'94–M'95–SM'99) was born in Rome, Italy, on April 25, 1970. He received the Dr.Eng. degree in electronics from the University of Rome "La Sapienza," Rome, Italy, in 1994, and the Ph.D. degree in electrical engineering from the University of Utah, Salt Lake City, in 1998.

He has been a consultant for several companies (1988–1994), a Visiting Researcher with the Italian National Board for New Technologies, Energy, and Environment (ENEA) (1994), a Visiting Researcher with the University of Rome "La Sapienza" (1994–1995), and a Research Associate (1995–1998) and Research Assistant Professor (1998–1999) with the University of Utah. He is currently an Associate Professor with the Department of Electrical and Computer Engineering, North Carolina State University (NCSU), Raleigh, where, from 1999 to 2003, he was an Assistant Professor. He has authored or coauthored over 80 international journal papers or conference presentations on FDTD modeling, dosimetry, and bioelectromagnetics. He is listed in *Who's Who in the World*, *Who's Who in America*, *Who's Who in Science and Engineering*, the *Dictionary of International Biographies*, and the 2000 *Outstanding Scientists of the 20th Century*.

Dr. Lazzi is an associate editor for the *IEEE Antennas and Wireless Propagation Letters*. He is the vice chair of Commission K (Electromagnetics in Biology and Medicine), U.S. National Committee of the International Union of Radio Science (URSI). He was the recipient of the 2003 ALCOA Foundation Engineering Research Achievement Award, a 2003 NCSU Outstanding Teacher Award, the 2003 NCSU Alumni Outstanding Teacher Award, a 2001 National Science Foundation (NSF) CAREER Award, a 2001 Whitaker Foundation Biomedical Engineering Grant for Young Investigators, a 1996 International Union of Radio Science (URSI) Young Scientist Award, and the 1996 Curtis Carl Johnson Memorial Award for the best student paper presented at the 18th Annual Technical Meeting of the IEEE Bioelectromagnetics Society (IEEE BEMS).



Om P. Gandhi (S'57–M'58–SM'65–F'79–LF'99) is currently a Professor of electrical engineering at the University of Utah, Salt Lake City. He was Chairman of the Department of Electrical Engineering, University of Utah (1992–1999). He has authored or coauthored several book chapters and over 200 journal papers on electromagnetic (EM) dosimetry, microwave tubes, and solid-state devices. He also edited *Biological Effects and Medical Applications of Electromagnetic Energy* (Englewood Cliffs, NJ: Prentice-Hall, 1990), and coedited *Electromagnetic Biointeraction* (New York: Plenum, 1989). He is listed in *Who's Who in the World*, *Who's Who in America*, *Who's Who in Engineering*, and *Who's Who in Technology, Today*.

Dr. Gandhi was elected a Fellow of the American Institute for Medical and Biological Engineering in 1997. He was president of the Bioelectromagnetics Society (1992–1993), cochairman of the IEEE SCC 28.IV Subcommittee on RF Safety Standards (1988–1997), and chairman of the IEEE Committee on Man and Radiation (COMAR) (1980–1982). He was the recipient of the d'Arsonval Medal of the Bioelectromagnetics Society for pioneering contributions to the field of bioelectromagnetics in 1995, the Microwave Pioneer Award of the IEEE Microwave Theory and Techniques Society (IEEE MTT-S) in 2001, and the State of Utah Governor's Medal for Science and Technology in 2002.

Shoogo Ueno (M'72–SM'96–F'01) was born on October 1, 1943, in Kumamoto, Japan. He received the B.S., M.Sc. and Ph.D. (Dr. Eng.) degrees from Kyushu University, Fukuoka, Japan, in 1966, 1968, and 1972, respectively.

From 1976 to 1986, he was an Associate Professor with the Department of Electronics, Kyushu University. From 1979 to 1981, he spent his sabbatical with the Department of Biomedical Engineering, Linkoping University, Linkoping, Sweden, as a Guest Scientist. From 1986 to 1994, he was a Professor with the Department of Electronics, Kyushu University. Since 1994, he has been a Professor with the Department of Biomedical Engineering, Graduate School of Medicine, University of Tokyo, Tokyo, Japan. He developed a method for localized magnetic stimulation of the human brain using a figure-eight coil, a computed topographic electroencephalography (EEG) mapping system, and impedance magnetic resonance imaging (MRI). His primary research interests include biomagnetics, transcranial magnetic stimulant, magnetoencephalography (MEG), neuronal current MRI, magnetic orientation and control of biological cells for tissue engineering, and the biological effects of magnetic and electromagnetic fields.

Dr. Ueno is president of the Bioelectromagnetics Society (BEMS), and president of the Japanese Society for Medical and Biological Engineering. He is past chairman of the International Scientific Radio Union (URSI) Commission K on Electromagnetics in Biology and Medicine, past president of the Magnetics Society of Japan, and past president of the Japan Biomagnetism and Bioelectromagnetics Society. He is also active in the IEEE Magnetics Society as an Administrative Committee (AdCom) member and the chair of the Biomagnetism Committee. He is a member of the Steering Committee and Editorial Board for the IEEE TRANSACTIONS ON NANOBIOSCIENCE. He was the recipient of the Doctores Honoris Causa (honorary doctor) presented by Linkoping University in 1998.