Guest Editorial

THE utilization of RF and microwave in the field of medicine continues to expand, and this TRANSACTIONS' "Special Issue on RF and Microwave Techniques in Wireless Implants and Biomedical Applications" is a good example. The growth in the field is based in part on translational success—moving research ideas to the market place, and in part on new research in understanding RF and microwave interaction with biological tissues.

Over the past few years, many researchers from various engineering disciplines have directed their interest to applications involving biomedical engineering and medical science. This movement has been encouraged by funding from government agencies, as well as from private sources. In addition, in the U.S., the collaboration between the Federal Drug Administration (FDA) and engineers and scientists seeking assistance and guidance has helped in accelerating the utilization of various technologies at bedside. On the other hand, advances in RF and microwave technology have created new opportunities for the utilization of wireless devices and equipment for medical uses such as implants, vital sign monitoring, imaging, and surgery. Moreover, efficient transmission through or over the body places great emphasis on the interaction of RF and microwave signals with human tissue. This is particularly true when antennas, transducers, and applicators are utilized for organ heating or the transfer of data through lossy tissue.

This TRANSACTIONS' Special Issue features papers from the U.S., U.K., Korea, Japan, and France. The presented papers fall into the following categories: two papers discuss implanted antennas including an antenna for ultra-wideband (UWB) applications and the evaluation of link budget for antennas inside digital human phantoms. Doppler radar systems for vital sign monitoring is the subject of two of the papers. Two of the papers deal with the heating applications, where an integrated microwave heat applicator and an inductive heating method and implants for treatment of luminal organs are discussed. The remaining papers cover diverse topics on RF/microwave medical applications and the wave interaction with tissues; namely, integration of UWB in surgical navigation, long-term and low-level microwave exposure of rats, a method for specific absorption rate (SAR) measurement for magnetic resonance imaging (MRI) coils, and novel and improved methods for broadband finite-difference time-domain (FDTD) simulations for biological tissues with Cole–Cole dispersion. In addition, a paper by Chow *et al.* describes a way to use stents as a radiating structure for transcutaneous power and data telemetries. A custom simulation model to predict the radiation pattern and the power absorption by the tissue is presented with measurements. The objective of the paper by Liu *et al.* is to present the structure and circuit implementation of a 400-MHz transmitter for neural recording applications. A phase MUX and inverter-based power amplifier are employed to achieve high power efficiency. Analysis of design considerations for the reliable operation of the proposed transmitter is presented as well. A paper by Cho *et al.* demonstrates a design methodology for an antenna combined with a body channel communication electrode. Evaluations of body channel characteristics are performed and a resonance transmitter buffer to drive on body antenna as an electrode is suggested for the required power reduction. A paper by Yuce *et al.* show the feasibility of wideband telemetry for both high and low data rate biomedical applications. Analysis on the UWB pulse generations for biomedical applications is provided and prototype implementations in two different applications are presented. A paper by Sodagar *et al.* presents an implantable microsystem that can wirelessly record 64 channels simultaneously. The system is powered through an inductive link, which is also used for the configuration and synchronization. The technical challenges and considerations in designing wireless implantable systems are also discussed.

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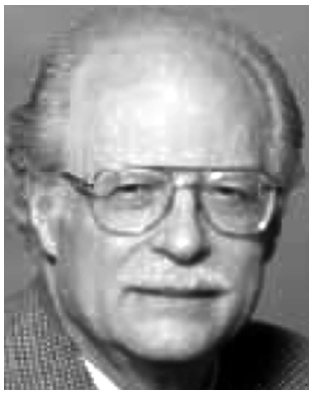

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