AP/ED/MTT Italy Chapter (North)

IEEE Distinguished Lecturers Series

Seminar Announcement

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IEEE MTT-S Distinguished Microwave Lecturer

RF Aspects of Magnetic Resonance Imaging

Wedn., May 07, 2014, 14:30

Dipartimento di Elettronica e Telecomunicazioni

Sala Conferenze V piano

Politecnico di Torino

suggested entrance: Corso Castelfidardo - 10129 Torino

Abstract

Magnetic Resonance Imaging (MRI) scanners are an important diagnostic tool for the medical practitioner. MRI provides a non-invasive means of imaging soft tissues and to obtain real-time images of the cardiovascular system and other dynamic changes in the human body. MRI scanners rely heavily on a number of topical areas of interest to Electrical Engineers: image processing, high speed computing and RF (radio frequency) systems and components. This presentation will focus on some of the RF aspects of the MR process and MR scanners. A primer on the physical phenomenon behind magnetic resonance will start the presentation and include a discussion of the origin of the MR signal. The need for the high static magnetic field (B_0), the use of gradient coils for MR signal location, simple RF pulse sequences and how they are used in image construction will be covered. This MR image construction process and the control of the various steps that manipulate the atomic nuclei to generate the final MR diagnostic image put demanding constraints on RF equipment capabilities and these will be discussed, along with a high-level overview of the various components making up conventional MRI systems. This high-level overview will include a look at various examples of transmit and receive RF systems and examples of transmit and receive coils that make up MR scanners and system diagrams for both the RF transmit and receive paths. The talk with then narrow in scope to look at how these RF coils are modeled and controlled in both transmit and receive states and how these components are used for transmit/receive switching and patient and equipment protection.

Biography – Robert H. Caverly received his Ph.D. degree in electrical engineering from The Johns Hopkins University, Baltimore, MD, in 1983. He received the M.S.E.E and B.S.E.E degrees from the North Carolina State

University, Raleigh, in 1978 and 1976, respectively. Dr. Caverly has been a faculty member at Villanova University in the Department of Electrical and Computer Engineering since 1997 and is a Full Professor. Previously, he was a Professor for more than 14 years at the University of Massachusetts Dartmouth (formerly Southeastern Massachusetts University). In 1990, with support from The National Science Foundation, he was a Visiting Research Fellow with the Microwave Solid-State Group at the University of Leeds in the United Kingdom. Dr. Caverly's research interests, funded by several government agencies and private industry, are focused on the characterization of semiconductor devices such as PIN diodes and FETs in the microwave and RF control environment. He has been involved with a number of IMS workshops, including co-organizing workshops in the magnetic resonance area, and has published more than 100 journal and conference papers in these and other technical and educational areas. He is the author of CMOS RFIC Design Principles from Artech House. Dr. Caverly has been co-chair of the IEEE Topical Conference on RF/microwave Power Amplifiers (PAWR) twice, in 2012 and 2013. He is on the editorial board of the IEEE Transactions of Microwave Theory and Techniques and Microwave and Components Letters, an associate editor of the IEEE Microwave Magazine, and past chairperson and current member of MTT-17, the HF-VHF-UHF Technology Technical Committee. An IEEE Fellow (2013), he is also a recipient of the Dow Outstanding Young Faculty Award from The American Society of Engineering Education and a two-time recipient (2007, 2013) of the Fr. Farrell Service Award from the College of Engineering at Villanova University. During his career, he has been a consultant for a number of microwave industries working on various microwave control element projects

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