RESEARCH IMAGING INSTITUTE FRIDAY SEMINAR SERIES

Faculty Sponsor: Dr. Timothy Duong

Jarek Wosik, Ph.D.

Research Professor of Electrical and Computer Engineering, University of Houston and Director of High Frequency Bioengineering Laboratory, Texas Center for Conductivity Houston, TX

"Cryogenic MRI coils and arrays: are the superconducting coils worth the trouble"

ABSTRACT: Noise in MRI systems, in general, is created by conductive losses in the coil and the body. There are two regimes of such conductive losses that control signal to noise ratio (SNR): the first one is body loss dominated and the second one is primarily coil loss dependent. It has long been recognized that when the coil loss is the governing source of noise, its reduction can be achieved by probe cooling and can result in significant increase of the overall SNR of measurements. The discovery and development of high-critical temperature superconducting (HTS) materials (which at 77 K exhibit an extremely low surface resistance R_s of an order of 150 μΩ at 10 MHz) has resulted in several attempts to build practical probes with improved SNR. Indeed, several studies have shown that for selected applications, where the MRI system noise is in the coil loss regime, such as low-field MRI, high-field microscopy, and small-volume MRI, HTS MRI receiver coils perform significantly better than comparable copper coils. For example, for microscopy resolution as high as 10 μm and for small animals two-fold and higher SNR gains over room temperature copper coils can be obtained. Implementation of cryogenic coils is challenging and difficulties arise mainly from necessity of using high Qs low loss matching/tuning and mutual inductance decoupling circuits. In most MRI array designs, optimal coil overlapping is used to minimize coupling between the nearest neighbors, while for the non-nearest neighbors low input impedance preamplifiers are implemented. However, for some imaging applications, such as partial parallel acquisition (PPA), coil overlap should be avoided in order to make complex sensitivity maps sufficiently distinguished. For cryogenic high-Q arrays, geometrical overlap is not practical because it increases the size of each element, thus increasing the ratio of body/coil losses without increasing the field of view (FOV). In the talk, cooled copper and superconducting coils and array designs for both small animals (4.7 T and 7 T) and clinical applications (3 T) will be presented. Modeling and low loss capacitive decoupling networks will be shown and in addition, specific requirements for MRI receiver coils cryogenic systems will be addressed.

Friday, December 11, 2009
3:00 p.m.

Research Imaging Institute, Seminar Room (Rm. 2.534)
McDermott Clinical Science Building; 8403 Floyd Curl Drive*

***Please note: Floyd Curl entrance closed due to construction, enter on Medical Drive & Von Scheele**

Refreshments will be served

Contact: Margie Gatica, 567-8176; gatica@uthscsa.edu