



## **Signal Processing Techniques in MRI**

Magnetic resonance imaging (MRI) is now a widely accepted medical imaging technique which is used on a daily basis along with conventional x-ray imaging, computed tomography (CT), ultrasound, and nuclear medicine. Although MR images are now commonplace, the formation of MR images requires extensive consideration of the relevant physics and engineering. Modern MRI machines are marvels of engineering.

Signal processing methods are an essential element of MR scanners, and such methods are important at a number of steps in the image formation process. Unlike x-ray images in which the image brightness is related only to material attenuation or thickness, the appearance of MR images depends upon multiple physical properties.

Signal modeling is necessary to determine the appropriate acquisition parameters necessary to obtain an image of desired contrast. Formation of an actual image requires that the signal receiver be tuned to the frequency of specific points in the patient. This is done by synchronously controlling multiple waveforms which govern radio frequency and magnetic gradient channels.

Once the data are acquired, the image is formed by spectrum analysis methods. With real-time imaging these steps are performed with customized high-speed signal processors. Finally, in some applications of MRI it is necessary to subject the raw images to additional mathematical algorithms to isolate the specific signals of interest.

This presentation will include description and examples of these various signal processing applications in MRI.

## **IEEE Section Meeting**

Stephen J. Rieder,  
**Signal Processing Techniques in MRI**

Monday, October 16, 7:00 pm  
Mayo Medical Sciences Building  
(321 3rd Avenue SW, Rochester)

☞ Pizza & socializing at 6:30 pm ☜

Stephen J. Riederer received his bachelor's degree in mathematics from the University of Wisconsin (UW) -Madison, his master's degree in nuclear engineering from Massachusetts Institute of Technology, and his Ph.D. degree in medical physics from UW-Madison.

He is currently Director of the Magnetic Resonance Laboratory and Professor of Radiology at the Mayo Clinic, a position he has held since 1988. Prior to coming to Mayo he worked as a senior physicist at General Electric Medical Systems, and he was a member of the faculty of the departments of Radiology and Biomedical Engineering at Duke University.

Dr. Riederer's principal research interests are in real-time magnetic resonance imaging (MRI) techniques, especially applications to cardiac, vascular and abdominal imaging. He has served as the principal advisor to 16 students who have received the Ph.D. degree in biomedical engineering or related fields. He is past president of the International Society for Magnetic Resonance in Medicine and is currently a member of the Scientific Advisory Committee of the Whitaker Foundation.



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