



## MR Elastography

### "Noninvasive Palpation" of the Human Body

by Armando Manduca, Ph.D.

In recent years, the ability to "look inside" the human body using various imaging technologies has dramatically increased physicians' ability to diagnose disease. But for all the benefits that contemporary medical imaging has brought to healthcare, it does not always show everything. In fact, one of the simplest and oldest of diagnostic techniques -- a physician's touch (palpation) -- is still more effective than modern imaging devices at detecting particular types of tumors.

During operations, for example, surgeons often palpate internal organs and sometimes find cancers that powerful imaging has not revealed. The reason palpation is so useful in diagnostic medicine is that tumors are often much harder than surrounding normal tissue. An imaging technique capable of sensitively examining the mechanical properties of tissues within the body may be very useful in detecting certain diseases at an early stage.

At Mayo we have been developing a new technique, termed Magnetic Resonance Elastography, that does just this. It works by sending harmless acoustic vibrations into the body. These sound waves move at different speeds depending on the hardness of the tissue they're passing through (sound travels through rigid material more quickly than soft material). The properly equipped MRI machine captures a cross-sectional image of the waves that is then processed by computer to produce a second image which shows the hardness or elasticity of tissues within the cross-section.

Initial results in test objects and tissue samples have shown that the method is capable of detecting very small vibration amplitudes and small differences in the mechanical properties of materials. An important potential application may be in detecting breast cancer, particularly in younger women whose dense breast tissue sometimes renders traditional mammography less reliable.

In this talk we will quickly outline the basic physical and signal-processing principles involved in magnetic resonance imaging, and explain how MR images are made. We will then explain how MR imaging can be modified to perform elastography, and show some examples of the current state of this work.

## IEEE Section Meeting

Armando Manduca

### MR Elastography

Monday, April 19, 7:00 pm  
Mayo Medical Sciences Building  
(321 3rd Avenue SW, Rochester)

☞ Pizza & socializing at 6:30 pm ☜

Armando Manduca received a B.A. in Mathematics from the University of Connecticut in 1974, and a Ph.D. in Astronomy from the University of Maryland in 1980. He has worked for NASA, for Mt. Wilson and Palomar Observatories, and for TRW on the Hubble Space Telescope Ground Station.

In 1989 Dr. Manduca joined Mayo, where he is co-director of the Biomathematics Resource and Associate Professor of Biophysics in the Mayo Graduate School. He is a member of the American Astronomical Society, the IEEE, the International Neural Network Society, the International Society for Magnetic Resonance in Medicine, Sigma Xi, and the Society of Photo-Optical Instrumentation Engineers. Dr. Manduca is an associate editor of the IEEE Transactions on Medical Imaging. His research interests are image processing, computer-aided diagnosis and computational intelligence.

## Nominees & Volunteers Needed

IEEE Southern Minnesota Section officers will be elected for the 1999-2000 term at our May section meeting. The following four officers will be elected: chair, vice chair, secretary, treasurer.

If you are an IEEE member in good standing, and if you would like to run for one of these offices -- or nominate someone else -- please contact any member of the nominating committee (Jason Clegg, Matthew Graham, Ron Jensen, and Tom Roettger).

We are also actively looking for volunteers to serve on various committees. We are generally well-staffed, so the workload isn't bad. Think about it!

**Minnesota State University, Mankato  
IEEE Meeting**

*James Wanberg*

**Electronic Scan Tools for Auto Engine Control  
Module Analysis**

*Tuesday, April 13, 5:00 pm  
Trafton Sciences Center, Room 241  
Minnesota State University, Mankato*

For several decades now, automobile engines have been controlled by onboard microprocessors, known in the industry as ECM's -- Engine Control Modules. The primary function of the ECM is to manage engine fuel delivery and timing.

Since the early 1980's, SPX Corp. (then called Owatonna Tool Corp.) saw an opportunity to provide independent automotive repair shops with aftermarket scan tools that interface to the ECM.

The scan tools enable service technicians to read ECM fault codes and parametric data in order to diagnose engine problems quickly and accurately.

SPX marketed its first ECM scan tool in 1983 and has since expanded its scan tool product line to cover all major US and foreign automobiles, as well as Cummins tractor-trailer engines, Harley Davidson motorcycles and Mercury Marine engines. The ECM scan tool has become a multimillion dollar business for SPX, whose handheld units have grown into sophisticated tools that run more than 32MB of custom software.

Our speaker, James Wanberg has been working on automotive engine electronics and analysis with SPX Corp. for 17 years. In his presentation, he will discuss technical details of ECM's and ECM scan tools, and he will cover the history of how these devices evolved from basic early designs to today's sophisticated units.

We plan to carpool to the campus for this meeting, leaving Rochester at approximately 2:30 p.m. If you'd like a ride, contact Paul Dahlinger at 253-1769 (work) or 282-4600 (home).



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**Telecommunications Faculty Openings**

Saint Mary's University of Minnesota, School of Graduate Studies, invites applications for part-time adjunct faculty positions in the Master of Science in Telecommunications Program offered at the Rochester Graduate Center. The program is offered on selected weekday evenings and Saturdays.

Applicants must have at least a master's degree from an accredited institution and expertise in one or more of the following areas: traffic engineering; data communications; video systems; LAN, WAN and international networks; internet applications; telephony; network planning and management; or multimedia systems.

Submit a letter of interest and current resume to: Site Coordinator, St. Mary's University Rochester Center, 851 30<sup>th</sup> Avenue SE, Rochester, MN 55904. *Saint Mary's University of Minnesota is committed to achieving diversity in its academic community. Members of protected classes as defined by federal, state, and municipal laws are strongly encouraged to apply. Saint Mary's University is an Equal Opportunity / Affirmative Action employer.*

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