Holcombe Department of Electrical and Computer Engineering and Department of Bioengineering Seminar

Magnetic Particle Imaging - a new imaging modality

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Abstract
Magnetic nanoparticle imaging is a new tomographic technique that allows fast, inexpensive imaging through the use of ferrofluid agents leading to submillimeter resolution. Selection fields combined with oscillating driving fields can move unsaturated field-free-points so as to cover the field of view. In previous studies, the average magnetization is assumed to respond instantaneously to changes in the applied field. We'll discuss a trade-off between sensitivity and resolution due to finite relaxation times, and the ensuing optimal particle size. We'll also discuss the latest developments pertaining to hyperthermia (killing tumors with heat), biomarkers (particles that attach themselves to targeted tissue such as tumors), and designer nanoparticles (the present ability to shape chains and flowers of nanoparticles).

Biography of Speaker

Robert W. Brown, Ph.D. is Institute Professor in the physics department of Case Western Reserve University. Dr. Brown and his industrial research and development group at Case have paved the way for three decades of magnetic coil products manufactured by Cleveland MRI industry. This industrial work has led to more than 200 publications and conference abstracts; upwards of 150 patents are presently held by people who have been trained in Brown's research group. His business and applied technical teams have worked in remarkably diverse areas, which include MRI, electromagnetic analysis, inverse methods, rf thermal ablation and heat equation investigations, radiation physics, nonlinear dynamics, EEG and MEG, clinical magnetic susceptometry, muscle fatigue modeling, functional and interventional imaging, and sensor development. Of the 20 Ph.D. industrial thesis students Robert Brown has advised, ten have outstanding business careers (including three CEO positions at major imaging firms), eight are professors or adjunct professors of physics, and one is a technical director at a national laboratory. Dr. Brown co-founded a pioneering master’s Program in Physics Entrepreneurship at Case in 2000, and he has served on the advisory committees for 25 graduates of this national award winning career track. In twenty years of teaching MRI, Brown and his former graduate and postgraduate students have co-authored a 900-page textbook that has become the "daily companion of the MRI scientist." He has received four national teaching honors based on recommendations by former students who have gone on to have successful careers and Brown's innovations in undergraduate and graduate teaching. Dr. Brown is a Fellow of the American Physical Society through the Forum on Industrial and Applied Physics, and, beginning in 2001, he has chaired or co-chaired four regional and international conferences in Cleveland.

The recent co-founding by a former student, Dr. H. Fujita, and Brown of Quality Electrodynamics LLC, an MR hardware development and manufacturing company in Cleveland, is a culmination of a long career in industrial design, applied research, and entrepreneurial physics education. A significant OEM customer base has already emerged for the new manufacturing company and it has grown to 60 employees, 15 of whom are Brown's former students and research associates. It has been estimated, based on two earlier companies in the same market and the success to date, that QED will grow in two more years to 200 employees. Brown has played a pivotal role in the emergence of two other new companies, ViewRay Inc. and AllTech Medical Systems; they also have former students in leadership positions.