

L. GUY RAGUIN

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QUALIFICATION SUMMARY Research scientist / engineer with over 9 years of experience in Nuclear Magnetic Resonance Imaging (NMR and MRI velocimetry, diffusion-weighted MRI, microscopic MRI). Projects involve pulse sequence development & programming, protocol optimization, image processing, and novel image reconstruction methods, applied to small animal, *ex vivo* specimen and phantom studies, as well as clinical research.

EDUCATION **University of Illinois at Urbana–Champaign (UIUC)** *Urbana, Illinois, USA*
 • Ph.D., Mechanical Engineering (GPA: 4.00/4.00) October 2004
 • M.S., Mechanical Engineering (GPA: 3.96/4.00) January 2000
Ecole National Supérieure des Mines de Nancy (ENSMN)
Institut National Polytechnique de Lorraine (INPL) *Nancy, France*
 • Engineering Diploma, Major/Minor: Energy/Materials Science July 1999
 • B.S., Major/Minor: Energy/Materials Science July 1998

CURRENT POSITION **Michigan State University (MSU)** *East Lansing, Michigan, USA*
Assistant Professor, Department of Mechanical Engineering
Adjunct Assistant Professor, Department of Radiology
Biomedical Imaging Research Center (BIRC, <http://www.birc.msu.edu>) Aug. 2006-present
 • Develops non-invasive diagnostics based on diffusion-weighted MRI and biophysical modeling for neurodegenerative and developmental diseases and aging
 • Optimizes diffusion-weighted and perfusion MRI protocols for fibrous soft tissue and skeletal muscle
 • Investigates development and treatment of muscle atrophy using MRI/MRS, and stem cell research
 • Investigates mixing/separation properties of two-phase flows in 3-D small-scale reactors using MRI
 • Develops MRI protocols to extract structural, mechanical, and transport properties of 3-D cell-seeded hydrogel biomaterials under controlled deformation and track cell metabolism using MRS
 • Performs functional and molecular MRI experiments using the Bruker 9.4 T AVANCE micro-imager and the GE 3 T EXCITE clinical scanner at BIRC

PROFESSIONAL EXPERIENCE **University of Illinois at Urbana–Champaign** *Urbana, Illinois, USA*
Research Associate, Biomed. Imaging Center, Lab. of Quant. Visualization Oct. 2004-Aug. 2006
 • Developed a quantitative diffusion-weighted MRI model that resolves fiber crossings in fibrous soft tissues, and implemented the corresponding experimental protocol and numerical reconstruction algorithm. Applied the method to human brain pons, a Zebra Finch brain and a rat brain using a Varian/INOVA 14.1 T imaging spectrometer
 • Extracted physical and transport properties of hydrogels (PEG, HEMA) using NMR/MRI protocols on Varian/SISCO 4.7 T and Varian/INOVA 14.1 T imaging spectrometers
 • Measured velocity fields in complex microfluidic systems using microscopic MRI phase contrast velocimetry protocols on Varian/SISCO 4.7 T and Varian/INOVA 14.1 T imaging spectrometers
 • Developed a fast and localized NMR velocimetry method for small channels and unsteady flows
Graduate Research Assistant, Biomedical Imaging Center Jan. 2000-Oct. 2004
 • Investigated kinematics, transport and chaotic segregation in complex 3-D swirling flows via MRI techniques (spin-tagging and phase-contrast velocimetry, pulsed-field gradient dispersion measurements) and numerical analysis of dynamical systems
 • Developed reconstruction methods for dynamic MRI velocimetry that impose physical constraints and allow for reduced-encoding data acquisition
 • Trained graduate students to operate a Varian/SISCO 4.7 T imaging spectrometer

Graduate Research Assistant, Lab. of Quantitative Visualization Jan. 2000-Mar. 2002

- Conducted the experimental study of vibrations effects on local heat flux and ice growth on a plate, instrumented the experimental device with thermocouples, heat flux sensors & PID controllers, and programmed a PC-based data acquisition system using LabVIEW

Graduate Research Assistant, Biomedical Imaging Center Aug. 1998-Dec. 1999

- Designed and conducted electrochemical mass transport experiments, designed and built a swirling reactor, and used spin-tagging MRI velocimetry on a Varian/SISCO 4.7 T scanner
- Responsible for fluid mechanics and heat/mass transport issues in the conception of a mesoscopic water purifier in a multidisciplinary project funded by DARPA

Institut de Mécanique des Fluides de Toulouse (IMFT) *Toulouse, France*

Graduate Research Assistant, Groupe d'étude sur les milieux poreux Summer 1999

- Installed an interface between the Biomedical Magnetic Resonance Laboratory at UIUC and the IMFT (a CNRS unit) for MRI experiments

Ecole National Supérieure des Mines de Nancy, INPL *Nancy, France*

Undergraduate Research Engineer, Department of Energy Feb.-June 1998

- Performed the numerical study of natural convection in a melting process, computed velocity and temperature fields and the advancing solidification front in collaboration with a CNRS unit.

Undergraduate Research Engineer, Department of Materials Science Oct.-Dec. 1998

- Computed numerically the electrical field in a microwave-induced plasma diamond-coating reactor to investigate anomalous coating patterns in collaboration with a CNRS unit.

PROFESSIONAL
ACTIVITIES

- ◇ Attended the "Introduction to ParaVision Course" (Sept. 11–15, 2006) and "Advanced Topics in ParaVision Course" (Apr. 30–May 4, 2007) at Bruker Inc., Billerica, MA, USA
- ◇ Successfully completed the "Training Tutorial on Human Subject Research Protections", "Animal Use and Care Tutorial" (Oct. 2006), and "Biological Safety Training" (Jan. 2008)
- ◇ Co-chaired the session "Biomedical Engineering I" for the 13th International Symposium on Applied Electromagnetics and Mechanics (ISEM 2007) in East Lansing, MI, USA, Sept. 9–12, 2007
- ◇ Member of the organizing committee and chaired four sessions for the 20th Inverse Problem Symposium (IPS07) in East Lansing, MI, USA, June 11–12, 2007
- ◇ Chaired the session "Cardiovascular and Pulmonary Systems II" and co-chaired the special session "Magnetic Resonance Imaging of Cardio/Cerebrovascular Flow and Cerebral Transport" at the 3rd European Medical & Biological Engineering Conference (EMBEC) in Prague (Czech Republic), 2005
- ◇ Technical reviewer for IEEE Transactions on Medical Imaging, Biomechanics and Modeling in Mechanobiology, 28th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 20th Inverse Problem Symposium, International Journal of Applied Electromagnetics and Mechanics, IEEE Transactions on Industrial Electronics, Journal of Heat Transfer, and Materials Research Society
- ◇ Member of the International Society for Magnetic Resonance in Medicine (ISMRM), the American Physical Society (APS), and the American Society for Engineering Education (ASEE)
- ◇ Member of Intermines (Alumni association for the Ecoles Nationales Supérieures des Mines de Paris, Nancy, and St-Etienne)
- ◇ Affiliated with the Beckman Institute for Advanced Science and Technology (2005-2006) and the following NSF sponsored Science and Technology Centers at the University of Illinois at Urbana-Champaign (2003-2006): Center of Advanced Materials for Purification of Water in Systems (WaterCAMPWS), and Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems (Nano-CEMMS)

CAMPUS
ACTIVITIES

- ◇ Member of the Biomedical Engineering Research Group at MSU, whose purpose is to design and establish a Biomedical Engineering Curriculum and Graduate Program (MS and PhD) within the College of Engineering at MSU
- ◇ Member of the Hydrogel Engineering and Imaging Group at MSU, whose aims are to engineer hydrogel-based systems, model hydrogel performance, and develop novel diagnostics for validation
- ◇ Designed and maintains the website for the Biomedical Imaging Research Center at MSU
- ◇ Co-coordinator for the Department of Mechanical Engineering Seminar series (2007–present)

- S. Majumdar, S. S. Udpa, **L. G. Raguin**, "Robust Optimization of Diffusion-Weighted MRI Protocols Used for Fiber Reconstruction", accepted to the 6th Int. Conf. on Inverse Problems in Engineering (ICIPE 2008): Theory and Practice, Dourdan, France, June 15–19, 2008.
- C. Bolin, **L. G. Raguin**, "Methodology to Estimate the Pressure Distribution from Noisy Velocity Data", accepted to the 6th Int. Conf. on Inverse Problems in Engineering (ICIPE 2008): Theory and Practice, Dourdan, France, June 15–19, 2008.
- G. Cordier, J. Choi, **L. G. Raguin**, "Evaluation of Three Inverse Problem Models to Quantify Skin Microcirculation Using Diffusion-Weighted MRI", accepted to the 6th Int. Conf. on Inverse Problems in Engineering (ICIPE 2008): Theory and Practice, Dourdan, France, June 15–19, 2008.
- L. G. Raguin**, "MRI Data Processing and Protocol Optimization using Biophysical Transport Modelling" (invited seminar), Laboratoire d'Energétique et de Mécanique Théorique et Appliquée (Laboratory of Energetics and Theoretical and Applied Mechanics), Nancy, France, January 10, 2008.
- L. G. Raguin**, S. Majumdar, S. S. Udpa, "Design of Optimal Experimental Parameters for Diffusion-Weighted MRI Fibre-Tracking Protocols" (invited talk), 13th Int. Symposium on Applied Electromagnetics and Mechanics (ISEM 2007), East Lansing, MI, USA, September 9–12, 2007.
- L. G. Raguin**, S. Majumdar, S. S. Udpa, "Parameter Estimation Analysis of Diffusion-Weighted MRI Protocols Used for Soft Tissue Fiber Reconstruction", 20th Inverse Problem Symposium (IPS07), East Lansing, MI, USA, June 11–12, 2007.
- L. G. Raguin**, et al., "MR Velocimetry Protocols for Small Water-Filled Channels", 59th Annual Meeting of the APS Division of Fluid Dynamics, Tampa Bay, FL, USA, November 19–21, 2006.
- J. G. Georgiadis, **L. G. Raguin**, "Particle Segregation in Oscillatory Taylor-Couette-Poiseuille Flow", 2nd Int. Conf. on Nonlinear Normal Modes and Localization in Vibrating Systems (NNMS 2006), Karlovasi, Samos, Greece, June 19–23, 2006.
- L. G. Raguin**, et al., "Micro-MRI Velocimetry in Microchannel Networks", Hilton Head 2006: A Solid State Sensor, Actuator and Microsystems Workshop, Hilton Head Island, SC, USA, June 4–8, 2006.
- L. G. Raguin**, et al., "Quantitative Analysis of q-Space MRI Data: Theoretical and Experimental Validation", 14th ISMRM Scientific Meeting, Seattle, WA, USA, May 6–12, 2006.
- L. G. Raguin**, "Investigation of Transport Phenomena using Magnetic Resonance Imaging" (invited seminar), Dept. of Mechanical Engineering, Michigan State University, East Lansing, MI, USA, May 3, 2006.
- L. G. Raguin**, et al., "Comparison of MRI Velocimetry Protocols for Microchannels", 47th Experimental Nuclear Magnetic Resonance Conf. (ENC 2006), Pacific Grove, CA, USA, April 23–28, 2006.
- L. G. Raguin**, et al., "Magnetic resonance imaging (MRI) of water diffusion in 2-hydroxyethyl methacrylate (HEMA) gels", 2006 Spring Meeting of the Materials Research Society JJ Symposium, San Francisco, CA, USA, April 17–21, 2006.
- L. G. Raguin**, et al., "Quantitative Analysis of q-Space MRI Data", 3rd European Medical & Biological Engineering Conf., Prague, Czech Republic, November 20–25, 2005; Paper in IFMBE Proceedings 11, edited by J. Hozman and P. Kneppo, 2005.
- L. G. Raguin**, et al., "MRI Velocimetry in Microchannel Networks", 3rd Annual Int. IEEE EMBS Special Topic Conf. on Microtechnologies in Medicine and Biology, Kahuku, HI, USA, May 12–15, 2005.
- L. G. Raguin**, et al., "MRI Quantification of Interstitial Water Transport and Diffusion in Novel Water Purification Systems", 3rd Annual Symposium, NSF Science and Technology Center of Advanced Materials for Purification of Water in Systems (Water CAMPWS), Atlanta, GA, USA, April 13–15, 2005.
- J. G. Georgiadis, S. L. Honecker, **L. G. Raguin**, "MRI Phantoms and Inverse Problems for the Structural and Functional Imaging of the Microvasculature", Frontiers of Biomedical Imaging Symposium: The MRI Novel Celebration and Future Directions, Beckman Institute, Urbana, IL, USA, November 8–10, 2004.
- L. G. Raguin**, et al., "An Inverse Problem for Reduced-Encoding MRI Velocimetry in Potential Flows", 26th Annual Int. Conf., IEEE Engineering in Medicine and Biology Society (EMBS), San Francisco, CA, USA, September 1–5, 2004.
- L. G. Raguin**, "Chaotic Segregation of Solid Particles in a Parametrically-Excited Swirling Flow" (invited seminar), Dept. of Mechanical Engineering, University of California at Riverside, Riverside, CA, USA, May 13, 2004.

L. G. Raguin, J. G. Georgiadis, "Use of Fluid Mechanics Constraints for Quantitative Magnetic Resonance Imaging", U.S. National Academy of Engineering, 2003 Midwest Regional Meeting, Urbana, IL, USA, April 8, 2003.

L. G. Raguin, J. G. Georgiadis, "Study of Passive Transport in Complex Flows with Ultrafast MRI", 6th ASME-JSME Thermal Engineering Joint Conf., Hawaii Island, HI, USA, March 16–20, 2003.

K. W. Moser, **L. G. Raguin**, J. G. Georgiadis, "Validation of Fast MRI Velocimetry in Rotating Phantom", Biomedical Engineering Society Meeting, Durham, NC, USA, October 4–7, 2001.

L. G. Raguin, K. W. Moser, J. G. Georgiadis, "Magnetic Resonance Imaging Study of Taylor-Couette-Poiseuille Flow", 12th Couette-Taylor Int. Workshop, Evanston, IL, USA, September 6–8, 2001.

J. G. Georgiadis, K. W. Moser, **L. G. Raguin**, "Quantitative Magnetic Resonance Imaging of Swirling Flows", 3rd Pacific Symposium on Flow Visualization and Image Processing, Maui, HI, USA, March 18–21, 2001.