

# Ananda Kumar

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**Profile:** Professional interests include RF, microwave, antenna systems engineering, EM modeling and simulations, RF safety, MRI coils and antennas, application of MR and optical imaging in diagnosis and study of physiological function. Proficient in the use of technical software; strong analytical skills; excellent communication skills.

**Education:**

<b>Doctor of Philosophy in Electrical Engineering</b> Johns Hopkins University Baltimore, Maryland	May 2008
<b>Master of Science in Bioengineering</b> Specialty in Medical Imaging University of Toledo Ohio	December 1999 <b>GPA 3.67</b>
<b>B.S.E in Biomedical Engineering (BME)</b> Minor in <b>Electrical Engineering (EE)</b> Mercer University Georgia	March 1996 <b>GPA 3.34</b>
<b>A.S. in Electronic Engineering</b> Institute of Technological Studies, Colombo, Sri Lanka (Affiliate institution of University of Houston, Clearlake, Texas)	May 1992 <b>GPA 3.62</b>

**Principal/  
Tech. Director:** **Resonant Research LLC**, specializes in custom designed high resolution, multi-nuclear, high field MRI coils and antennas.

**Consultant:** **Lambda Z Technologies Inc.**, MRI safety of implantable devices, magnetic field induced hyperthermia cancer treatment device design and safety analysis. EM modeling and simulation of RF safety using frequency and time domain methods including FEM, Method of Moments, and FDTD.

**Visiting Research Associate: Johns Hopkins University, Department of Radiology**

**Research Experience :** Research Associate (Mar.'00- July'08): *Department of Radiology, Johns Hopkins University, Baltimore, MD.*

Research and development in RF circuits and antenna designs for MR imaging. Responsible for the operation of RF electronics laboratory.

- Designed and developed biopsy needle antenna for high resolution *in situ* imaging.
- Designed and developed high-resolution surface coil for imaging skin lesions and pathology samples.
- Developed intra-vascular RF coils, matching circuits, and other peripheral electronics for imaging.
- Development of optimally performing tunable planar strip array antenna using Method of Moment Electro-magnetic (EM) modeling and simulations.
- Developed "Phi-coil", a novel quadrature MR detector and determined optimal design rules for figure 8 shaped loop detectors at 3T.
- Determined the Noise Figure (NF) limits of circular loop coils in MR conventional and phased-array applications.

Research and development of optical imaging system for fluorescence imaging to monitor vascularexpression.

- Monte-Carlo modeling and design of optical probes for imaging fluorescence markers in vascular tissue.

GE Medical Systems, Applied Science laboratory, Waukesha, WI: designed and built 6 channel phased array coils for carotid artery imaging. Oct.-Nov.2004

Philips Medical, Cleveland, OH: RF coil workshop. June 2008.

*Research Assistant* (Jan.'98 – Dec.,'99): *Medical Imaging and Informatics Laboratory, Department of Bioengineering, University of Toledo, OH.*

Worked on multi-spectral non-invasive optical imaging of skin lesions for early diagnosis of malignant melanoma. Research work involves development of multi-spectral optical imaging. Multi-spectral image processing and image restoration. 3D-image reconstruction from 2 D-projections obtained by Nevoscope, an optical non-invasive imaging device for skin lesions.

- Designed and developed optical imaging assemblies.
- Patient image data collection, archiving and data base maintenance at Medical College of Ohio, surgical oncology clinic.
- Image processing in C and C++

*Research Assistant* (Sep.'96 – Dec.'97): *Roger's Magnetic Resonance Center, University of Texas- Southwestern Medical Center, Dallas, TX.*

Research work involved in Sodium - 23 Multiple Quantum NMR imaging to diagnose tumor and lung edema.

- Gained experience in NMR imaging/spectroscopy and operation of GE 4.7 T MR equipment and Varian 600 MHz spectrometer.
- Designed and built RF transmitter/receiver coils for small animal imaging and spectroscopy.
- Animal preparation and surgery for imaging experiments.

*Senior Design Project* (Sep.'95 - Apr.'96): *Mercer University, Macon, GA*

Designed and built an electronic occupational therapy device for children who lack fine motor control and visual sequential memory.

- Gained experience and exposure to engineering design process.
- Designed electronic circuitry; interfaced and programmed 87C51 micro-controller.
- Precision manufactured plastic components by programming and using CAD/CAM tool.
- The design won the first place in IEEE- Whitaker foundation design competition.

**Computer Skills:**

Programming Languages :

C++/C, Pascal, FORTRAN, BASIC, Assembly language, HTML

Technical Softwares on Unix and Windows platforms:

Matlab, FEKO, SEMCAD- *for EM simulations*, Gcad, ADS, SiMetrix, Altium *–for RF/Analog circuit modeling and simulation*

**Software experience:**

- Understood and modified existing codes in C/C++ languages and implemented new modules for image reconstruction and image processing for master's project work.
- Developed image processing and neural network classification algorithms in Matlab.
- Programmed 87C51 Micro-controller in Assembly language for senior design project.

**Related EE & BME Courses:**

Random Signals and Noise

RF circuits I & II

NMR Principles

Wavelets and their applications

Biomedical Instrumentation

Antenna Systems

Anatomy and Physiology

Digital Signal Processing

Computational Electromagnetics

NMR spectroscopy

Medical Imaging

Biomedical Application of Microcontrollers

Optical Biomedical Instrumentation

Principles of Micro-wave circuits

**Awards and Scholarships:**

Research Assistantship - University of Toledo, OH, Department of Bioengineering.

Research Assistantship - UT - Southwestern Medical Center, Biomedical Engineering Program

Dean's List, National Engineering Honor Society - Tau Beta Phi

1<sup>st</sup> Place IEEE (EMBS)-Whitaker Foundation student design competition 1996.

Transfer University Scholarship, Continuing Student Scholarship - Mercer University Macon GA

2001 American Heart Association Melvin A. Judkins Young Investigator Award, X. Yang, Ergin Atalar, D Li, JM Serfaty, D Wang, A Kumar, L Cheng, In vivo MR imaging of catheter-based vascular gene transfer.

- Patents:** “Biopsy and Sampling Needle Antennas for Magnetic Resonance Imaging-Guided Biopsies”  
**Ananda Kumar**, Ergin Atalar, Ogan Ocali Patent No.: US 7236816 B2
- “Digital Optical Imaging for Tracking Vascular Gene Expression and Early Diagnosis of Atherosclerosis”  
 Xiaoming Yang, **Ananda Kumar**, Hunter Chen (International application Serial No. WO 02/080756)
- “Optimized MRI strip array detectors and apparatus, systems and methods related thereto” Paul A. Bottomley, **A. Kumar**, US Patent Application #20090015256, filed May 2007.
- Publications:** **A. Kumar**, P.A. Bottomley, “Optimizing the Intrinsic Signal-to-Noise Ratio of MRI Strip Detectors”  
 Magnetic Resonance in Medicine, vol.56(1), pp. 157-166, July 2006. (Times cited 2).
- A.Kumar**, P.A. Bottomley, “Optimized Quadrature Surface Coil Designs”  
 Magnetic Resonance Materials in Physics, Biology and Medicine (MAGMA), vol.21, pp. 41-52, March 2008.
- A.Kumar**, W.A. Edelstein, P.A.Bottomley, “Noise Figure Limits for Circular Loop MR Coils”  
 Magnetic Resonance in Medicine, vol. 61, pp.1201-1209, May 2009.
- J. M. Serfaty, X. Yang, T. Foo, **A. Kumar**, A. Derbyshire, E. Atalar,  
 “Coronary Artery Intervention Guided With Magnetic Resonance Imaging”,  
 Magnetic Resonance in Medicine, vol.49, pp. 258-263, February 2003. (Times cited 18 )
- X. Yang, E. Atalar, D. Li, J. M. Serfaty, D. Wang; **A. Kumar**, L. Cheng,  
 “Magnetic Resonance Imaging Permits In Vivo Monitoring of Catheter-Based  
 Vascular Gene Delivery”, Circulation, 104(17), pp.1588-1590, October, 2001. (Times cited 38)
- Ananda Kumar**, Hunter Chen, Danming Wang, Xiaoming Yang, “Non-invasive Optical imaging of Green  
 Fluorescent Protein Markers in Vascular Gene Therapy: A feasibility study in human tissue-like phantoms”, SPIE –  
 Proceedings of SPIE vol. 4623, pp. 339-345.
- Chen HH, Zhen JX, **Kumar A**, Du XY, Cheng LZ, Yang XM. Detection of dual gene expression in arteries using a  
 simple optical imaging method. Journal of Biomedical Optics, vol.9, pp. 1223-1229, December 2004, (Times cited  
 1).
- Kar S, **Kumar A**, Gao F, Zhan X, Qiu B, Yang XM. Development of a Percutaneous Optical Imaging System to  
 Track Vascular Reporter Gene Expression In Vivo. Journal of Biomedical Optics, vol.11, June 2006.
- Conference & Symposiums** **Ananda Kumar**, Gene Mercado, George Hart, “Hook’em up – a game board approach to promote hand-eye  
 coordination and visual sequential memory”, presented the senior design project at the 18th Annual IEEE -  
 Engineering in Medicine and Biology Society conference in Amsterdam, Netherlands, November 1996.
- Srinath Maganti, **Ananda Kumar**, Atam P. Dhawan, “New Model for Optical Image Reconstruction for Nevoscope  
 Images”, Poster session at SPIE’s International Symposium on Medical Imaging 1999, San Diego,  
 Symposiums:CA, February 1999:
- Ananda Kumar**, Atam P. Dhawan, Patricia Relue, Prabir K. Chaudhuri, “Multi-Spectral Optical Imaging of Skin to  
 Diagnose Malignant Melanoma”, Paper presented at the IEEE-EMBS/BMES conference, Atlanta, October 1999.
- Ananda Kumar**, Atam P. Dhawan, Patricia Relue, Prabir K. Chaudhuri  
 “Restoration of Inhomogeneously Trans-illuminated Color Images of Skin Lesions”  
 Poster session at the World Congress on Medical Physics and Biomedical Engineering 2000,  
 Chicago, IL
- Ananda Kumar**, Ergin Atalar, “MR Imaging with a Biopsy Needle”, in  
 Proceeding of the Annual ISMRM Meeting, p. 2148 Glasgow, Scotland, 2001

Yang XM, Atalar E, Li D, Serfaty JM, **Kumar A**, Cheng L: "Magnetic Resonance Imaging Permits in vivo Monitoring Catheter-based Vascular Gene Transfer", 87th Scientific Assembly and Annual Meeting, Radiological Society of North America, Chicago, Illinois, USA. November 26-December 1, 2001.

Chen HH, **Kumar A**, Yang Y, Wang D, Maouyo D, Fried NM, Yang XM: "Development of a non-invasive Optical Imaging Method for Tracking Vascular Gene Expression", 23<sup>rd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001.

Yang XM, Atalar E, Li D, Serfaty JM, Wan D, **Kumar A**, Cheng L: "In vivo MR Imaging of Catheter-based Vascular Gene Transfer", 23<sup>rd</sup> Annual International Conference of the IEEE Engineering in Medicine and Biology Society, October 25-28, 2001.

**Ananda Kumar**, Paul A. Bottomley, "Tunable Planar Strip Array Antenna", Annual ISMRM Meeting, Honolulu, Hawaii, May 18-24, 2002.

**Ananda Kumar**, Hunter H. Chen, Danming Wang, Xiaoming Yang. "Monitoring of Vascular Gene Expression via optical imaging", Progress in Biomedical Optics and Imaging, 2002.

**Ananda Kumar**, Hunter. H. Chen, Erin Long, Xiaoming Yang, "Design of Minimally Invasive Optical Imaging Probes to Track Vascular Gene Expression: A Monte Carlo Simulation Analysis", Proceedings. 2002 IEEE International Symposium 2002, Page(s): 285 - 288

Kar S, **Kumar A**, Yang XM. Development of a percutaneous optical imaging system for tracking vascular gene expression: a feasibility study using human tissue like phantoms. SPIE, San Diego, CA, February 14-18, 2004.

Kar S, **Kumar A**, Yang XM. Development of a percutaneous optical imaging system for tracking vascular gene expression: An ultrasound-guided ex vivo feasibility study. ISBI 2004, Richmond, VA.

Kar S, **Kumar A**, Gao FB, Qiu BS, Yang XM. Optical imaging of marker gene expression in vasculatures. IEEE/ISBI/NIH workshop on optical imaging. Bethesda, September 20-22, 2004.

Kar S, **Kumar A**, Gao F, Zhan X, Qiu B, Yang XM. Development of a Percutaneous Optical Imaging System to Track Vascular Reporter Gene Expression In Vivo. Third Annual Meeting of the Society for Molecular Imaging. St. Louis, September 9-12, 2004.

**Ananda Kumar**, Paul A. Bottomley, "Optimizing the SNR performance of the Tunable Strip Detector", 14<sup>th</sup> Annual ISMRM Meeting, Seattle, Washington, May 6-12, 2006.

**Ananda Kumar**, Paul A. Bottomley, "Optimized Quadrature Surface Coils incorporating, Circular loops, Figure-8's and Strips", 15<sup>th</sup> Annual ISMRM Meeting, Berlin, Germany, May 19-24, 2007.

**Ananda Kumar**, W. A. Edelstein, Paul A. Bottomley, "Noise Figure Limits of Circular Loop MR Coils", 17<sup>th</sup> Annual ISMRM Meeting, Honolulu, Hawaii, April 18-24, 2009.

Paul A. Bottomley, W. A. Edelstein, **A Kumar**, J. M. Allen, P. Karmarkar, "Resistance and Inductance Based MRI-safe Implantable Lead Strategies", 17<sup>th</sup> Annual ISMRM Meeting, Honolulu, Hawaii, April 18-24, 2009.

### **Technical Reports**

"Effects of Sampling on MR Image Reconstruction", (Spring 1998). **Ananda Kumar**, Dept. of Bioengineering, University of Toledo, OH.

"Magnetic Resonance Imaging and K-space: Exploring Scan time reduction and its Effects on Image Quality", (Fall, 1997), **Ananda Kumar**, Brent Sakowski, Rahul Tamhane, Biomedical Engineering program, University of Texas – Southwestern Medical Center, Dallas, TX.