

Alan V. Sahakian, May 2012

CURRENTLY, AT NORTHWESTERN UNIVERSITY:

Professor and Chair of Electrical Engineering and Computer Science (EECS)
Professor of Biomedical Engineering
Director of the Signals and Systems Division of the EECS Department
Member of the Academic Affiliate Staff, Department of Medicine, NorthShore University Health System (Evanston Hospital)
Fellow of the IEEE and AIMBE

RESEARCH INTERESTS:

The primary research interest of my lab is the electrophysiology of the atrial cardiac arrhythmias, in particular atrial fibrillation, and electrotechnologies for arrhythmia management. We also have an interest in electromagnetic and photonic methods for medical and non-medical imaging and monitoring, and nanoparticle interactions.

EDUCATION:

5/1984 **Ph.D.** in Electrical and Computer Engineering with a minor in Computer Science from the University of Wisconsin-Madison. Thesis title: “*Algorithm, Architecture and Electrode Studies for Apnea Monitoring using a Multi-Microprocessor System.*” Major advisor: Willis J. Tompkins (ECE). Minor Advisor: Edward F. Moore (CS)

8/1979 **MSEE** from the University of Wisconsin-Madison. Thesis title: “*A Microprocessor-Based Arrhythmia Monitor/Recorder for the Operating and Recovery Rooms*”

5/1976 **BS** in Applied Science, and in Physics from the University of Wisconsin- Parkside.

EXPERIENCE:

2000-present:

Professor of Electrical Engineering and Computer Science (formerly Electrical and Computer Engineering) and of Biomedical Engineering, Northwestern University.

Chairman of Electrical Engineering and Computer Science Department (July 2011 – present)

Associate Chairman of EECS/ECE Department for Undergraduate Program (2003-July 2011).

Director of EECS Signals and Systems Division (2005-present).

Charles Deering McCormick Chaired Professor of Teaching Excellence (1999-2002)

1990-2000:

Associate Professor of Electrical Engineering and Computer Science (now Electrical and Computer Engineering) and of Biomedical Engineering,

Bette and Neisen Harris Chaired Professor of Teaching Excellence (9/93-8/95)

Director of ECE Instructional Labs (9/98-8/00)

Associate Chairman for ECE Undergraduate Program and Accreditation (9/93-8/98).

1984-1990: **Assistant Professor** of Electrical Engineering and Computer Science, Northwestern University, with courtesy appointment in Biomedical Engineering.

1985-present: **Member: Academic Affiliate Staff** (formerly Associate Professional Staff) Department of Medicine, Evanston Hospital (NorthShore University HealthSystem).

Summer 1987: **Resident Visiting Scholar**, Center for Excellence in Reliability and Maintainability, Air Force Institute of Technology, Wright Patterson Air Force Base, Dayton, OH.

1980-84 and 1978 - 79: **Research Assistant**, Electrical and Computer Engineering Department, University of Wisconsin-Madison.

1982-1983: **Electrical Engineer**, Applied Electronic Consultants Inc. and sister corporation Bahr Technologies, Madison, WI.

1979-1980: **Senior Electrical Engineer** at Medtronic Inc., Minneapolis, MN.

PUBLICATIONS AND PATENTS:

RECENT SUBMISSIONS:

1. I.V. Mikhelson, P. Lee, S. Bakhtiari, T.W. Elmer, A.K. Katsaggelos and A.V. Sahakian, "Non-Contact Millimeter-Wave Real-Time Detectoin and Tracking of Heart Rate with a Non-Stationary Subject," Submitted to IEEE Transactions on Information Technology in Biomedicine.
2. S.Liao, S. Bakhtiari, T.Elmer, A.C.Raptis, I.V.Mikhelson and A.V. Sahakian, "Millimeter Wave I-Q Standoff Biosensor," to appear at SPIE Defense, Security and Sensing Conference, Baltimore, MD, 2012.

JOURNAL PAPERS:

- 1) O.O. Adeyanju, H.M. Al-Angari and A.V. Sahakian, "The Optimization of Needle Electrode Number and Placement for Irreversible Electroporation of Hepatocellular Carcinoma," Radiology and Oncology, (online now), 2012.
- 2) A.V. Sahakian, H. M. Al-Angari, and O.O. Adeyanju, "Electrode Activation Sequencing Employing Conductivity Changes in Irreversible Electroporation Tissue Ablation," IEEE Transactions on Biomedical Engineering, Vol. 59(3), pp. 604-607, March 2012.
- 3) H. al-Angari and A.V. Sahakian, "Automated Recognition of Obstructive Sleep Apnea Syndrome Using Support Vector Machine Classifier," IEEE Transactions on Information Technology in Biomedicine, Vol. 16(3), pp. 463-468, May 2012.
- 4) S. Bakhtiari, T.W. Elmer, N.M. Cox, N. Gopalsami, A.C. Raptis, S. Lin, I.V. Mikhelson and A.V. Sahakian, "Compact Millimeter Wave Sensor for Remote Monitoring of Vital

- Signs,” IEEE Transactions on Instrumentation and Measurement, Vol.61(3), pp. 830-841, March 2012.
- 5) O.O. Adeyanju, H. al-Angari and A.V. Sahakian, “The Improvement of Irreversible Electroporation Therapy Using Saline-Irrigated Electrodes: a Theoretical Study,” *Technol Cancer Res Treat.* Vol.10(4), pp. 347-60, August 2011.
 - 6) I.V. Mikhelson, S. Bakhtiari, T.W. Elmer and A.V. Sahakian, “Remote Sensing of Heart Rate and Patterns of Respiration on a Stationary Subject Using 94 GHz Millimeter Wave Interferometry,” *IEEE Transactions on Biomedical Engineering*, Vol. 58, Issue 6, pp. 1671-1677, June 2011.
 - 7) J. Koenig, A.V. Sahakian, A. Ricke, and S. Swiryn, “Observations of Pacemaker Pulses in High Bandwidth Electrocardiograms and Dower-estimated Vectorcardiograms,” *Journal of Electrocardiology*, Vol. 44, pp. 275-281, 2011.
 - 8) Y. Guo, Y. Zhang, G.M. Nijm, A.V. Sahakian, G.-Yu Yang, R.A. Omary, and A.C. Larson, “Irreversible Electroporation in the Liver: Contrast-enhanced Inversion-Recovery MR Imaging Approaches to Differentiate Reversibly Electroporated Penumbra from Irreversibly Electroporated Ablation Zones,” *Radiology*, Vol. 258, pp. 461-468, Feb. 2011.
 - 9) Y. Zhang, Y. Guo, A.B. Ragin, R.J. Lewandowski, G.-Y. Yang, G.M. Nijm, A.V. Sahakian, R. Omary and A.C.Larson, “MR Imaging to Assess Immediate Response to Irreversible Electroporation for Targeted Ablation of Liver Tissues: Preclinical Feasibility Studies in a Rodent Model,” *Radiology* 256(2), pp. 424-432, 2010.
 - 10) A. Mashal, B. Sitharaman, X. Li, P.K. Avti, A.V. Sahakian, J.H. Booske, and S.C. Hagness, “Toward Carbon-Nanotube-Based Theranostic Agents for Microwave Detection and Treatment of Breast Cancer: Enhanced Dielectric and Heating Response of Tissue-Mimicking Materials,” *IEEE Transactions on Biomedical Engineering*, 57(8), pp. 1831-1834, 2010.
 - 11) Y. Guo, Y. Zhang, R. Klein, G.M. Nijm, A.V. Sahakian, R.A. Omary, G.-Yu Yang, and A.C. Larson, “Irreversible Electroporation Therapy in the Liver: Longitudinal Efficacy Studies in a Rat Model of Hepatocellular Carcinoma,” *Cancer Research*, 70(4), pp. 1555-1563, 2010.
 - 12) A. Heifitz, S-C Kong, A.V. Sahakian, A. Taflove, V. Backman, “Photonic Nanojets,” *Journal of computational and Theoretical Nanoscience*, 6(9), pp. 1979-1992, 2009.
 - 13) S. Petrutiu, A.V. Sahakian, W. Fisher and S. Swiryn, “Manifestation of Left Atrial Events and Inter-atrial Frequency Gradients in the Surface Electrocardiogram during Atrial Fibrillation: Contributions from Posterior Leads,” *Journal of Cardiovascular Electrophysiology*, 2009.
 - 14) A.D. Ricke, S. Swiryn, A.V. Sahakian, S. Petrutiu, B. Young, and G.I. Rowlandson, “The relationship Between Programmed Pacemaker Pulse Amplitude and Surface ECG recorded Amplitude: Application of a New High Resolution ECG System,” *Journal of Electrocardiology*, Vol. 41(6), pp. 526-530, November 2008
 - 15) G.M. Nijm, A.V. Sahakian, S. Swiryn, J.C. Carr, J.J. Sheehan and A.C. Larson, “Comparison of Self-Gated Cine MRI Retrospective Cardiac Synchronization Algorithms,” *Journal of Magnetic Resonance Imaging*, 2009.

- 16) G.M. Nijm, S. Swiryn, A.C. Larson and A.V. Sahakian, "Extraction of the Magneto-hydrodynamic Blood Flow Potential from the Surface Electrocardiogram in Magnetic Resonance Imaging," *Medical and Biological Engineering and Computing (MBEC1054R2)* 2009.
- 17) S-C Kong, A.V. Sahakian, A. Taflove and V. Backman, "Photonic nanojet-enabled optical data storage," *Optics Express*, Vol. 16, Issue 18, pp. 13713-13719, 2008
- 18) S-C Kong, A.V. Sahakian, A. Heifetz, A. Taflove and V. Backman, "Robust Detection of Deeply Subwavelength Pits in Simulated Optical Data-Storage Disks Using Photonic Jets," *Applied Physics Letters* 92, 911102, 2008 (DOI:10.1063/1.2936993), (Cover article).
- 19) E C Ehman, P J Rossman, S A Kruse, A V Sahakian and K J Glaser, "Vibration safety limits for magnetic resonance elastography," *Physics in Medicine and Biology*, 53, pp. 925-935, 2008.
- 20) M.S. Guillem, A.V. Sahakian and S. Swiryn, "Derivation of Orthogonal Leads from the 12-Lead ECG. Performance of an atrial-based transform for the derivation of P loops," *Journal of Electrocardiology* 41(1) pp. 19-25, 2008.
- 21) H. al-Angari and A.V. Sahakian, "Use of Sample Entropy Approach to Study Heart Rate Variability in Obstructive Sleep Apnea Syndrome," *IEEE Transactions on Biomedical Engineering*, 54(10) pp. 1900-1904, 2007.
- 22) S. Petrutiu, A.V. Sahakian and S. Swiryn, "Abrupt changes in fibrillatory wave characteristics at the termination of paroxysmal atrial fibrillation in humans," *Europace*, 9(7), pp. 466-470, 2007.
- 23) M. Ruffolo, M.S. Daskin, A.V. Sahakian and R. Berry, "Design of a Large Network for Radiological Image Data," *IEEE Transactions on Information Technology in Biomedicine*, 11(1) pp. 25-39, 2007.
- 24) S. Petrutiu, A.V. Sahakian and S. Swiryn, "Short-Term Dynamics in Fibrillatory Wave Characteristics at the Onset of Paroxysmal Atrial Fibrillation in Humans," *The Journal of Electrocardiology*, 40(2) pp. 155-160, 2007.
- 25) A. Heifetz, K. Huang, A.V. Sahakian, X. Li, A. Taflove and V. Backman, "Experimental Confirmation of Backscattering Enhancement Induced by a Photonic Jet," *Applied Physics Letters*, 89(221118), pp. 2006.
- 26) S. Petrutiu, J. Ng, G. M. Nijm, H. al-Angari, S. Swiryn and A.V. Sahakian, "Atrial fibrillation and waveform characterization in the surface ECG – a time domain perspective," (Invited Paper), *IEEE EMBS Magazine*, 25(6) pp. 24-30, Nov.2006.
- 27) J. Ng, A.V. Sahakian, W.G. Fisher and S. Swiryn, "Atrial Flutter Loops Derived from the Surface ECG: Does the Plane of the Loop Correspond Anatomically to the Macro-reentrant Circuit," *The Journal of Electrocardiology*, 2005.
- 28) Q. Xi, A.V. Sahakian, T.G. Frohlich, J. Ng, S. Swiryn, "The relationship between the pattern of occurrence of atrial fibrillation and surface ECG fibrillatory wave characteristics," *Heart Rhythm*, 1, pp. 656-663, 2004.

- 29) J. Ng, A.V. Sahakian, W.G. Fisher and S. Swiryn, "Surface ECG vector characteristics of organized and disorganized atrial activity during atrial fibrillation," *Journal of Electrocardiology*, 37(supplement), pp. 91-97, 2004.
- 30) Q. Xi, A.V. Sahakian, J. Ng, and S. Swiryn, "Atrial fibrillatory wave characteristics in the surface electrocardiogram: consistency over twenty-four hours in clinically stable patients," *Journal of Cardiovascular Electrophysiology*, 15(8), pp. 1-7, August 2004.
- 31) J. Ng, A.V. Sahakian and S. Swiryn, "Accelerometer-Based Body-Position Sensing for Ambulatory Electrocardiographic Monitoring," *Biomedical Instrumentation and Technology*, 37(5), pp. 338-346, 2003.
- 32) Q. Xi, A.V. Sahakian and S. Swiryn, "The effect of QRS cancellation on atrial fibrillatory wave signal characteristics in the surface electrocardiogram," *The Journal of Electrocardiology*, 36(3), pp. 243-249, 2003.
- 33) A.V. Sahakian, M.-S. Lee-Peterson, S. Shkurovich, M. Hamer, T. Votapka, T. Ji and S. Swiryn, "A simultaneous multichannel monophasic action potential electrode array for in vivo epicardial repolarization mapping," *IEEE Transactions on Biomedical Engineering*, 48(3), pp. 345-353, 2001.
- 34) S. Shkurovich, A.V. Sahakian, T.V. Votapka, T.Ji and S. Swiryn, "Multi-site monophasic action potential mapping of atrial repolarization in vivo: is atrial repolarization a two or three dimensional process?," *The Journal of Electrocardiology*, 33(1) supplement, pp. 127-131, 2001.
- 35) D.K. Serkland, G.D. Bartolini, W.L. Kath, Prem Kumar, and A.V. Sahakian, "Rate multiplication of a 59-GHz Soliton Source at 1550 nm," *IEEE/OSA Journal of Lightwave Technology*, 16(4), pp. 670-677, 1998.
- 36) S. Shkurovich, A.V. Sahakian and S. Swiryn, "Detection of atrial activity from high voltage leads of implantable defibrillators using a cancellation technique," *IEEE Transactions on Biomedical Engineering*, 45(2), pp. 229-234, 1998.
- 37) A.T. Schoenwald, A.V. Sahakian, H.J. Sih and S. Swiryn, "Further observations of "linking" of atrial excitation during clinical atrial fibrillation," *PACE*, 21, pp. 25-34, 1998.
- 38) A.T. Schoenwald, A.V. Sahakian and S. Swiryn, "Discrimination of atrial fibrillation from regular atrial rhythms by spatial precision of local activation directions," *IEEE Transactions on Biomedical Engineering*, 44(10), pp. 958-963, 1997.
- 39) S.N. Laxminarayan, J-L. Coatrieux, C. Roux, S.M. Finkelstein, A.V. Sahakian and S.M. Blanchard, "Biomedical Information Technology: Medicine and Health Care in the Digital Future," *IEEE Transactions on Information Technology in Biomedicine*, 1(1), pp. 1-7, 1997.
- 40) S.M. Shors, A.V. Sahakian, H.J. Sih and S. Swiryn, "A method for determining high-resolution activation time delays in cardiac mapping," *IEEE Transactions on Biomedical Engineering*, 43(12), pp. 1192-1196, 1996.
- 41) A.T. Schoenwald, A.V. Sahakian and S. Swiryn, "Detecting atrial fibrillation using spatial precision," *IEEE EMBS Magazine (invited)* Vol. 15(3), pp. 45-51, 1996.

- 42) C.L. Chan, A.K. Katsaggelos and A.V. Sahakian, "Linear-quadratic noise-smoothing filters for quantum-limited images, *IEEE Transactions on Image Processing*, 4(9), pp. 1328-1333, 1995.
- 43) H.J. Sih, A.V. Sahakian, C.E. Arentzen and S.Swiryn, "A frequency domain analysis of epicardial maps," *IEEE Transactions on Biomedical Engineering*, 42(7), pp. 718-727, 1995.
- 44) N. Maglaveras, F. Offner, F. VanCappelle, M. Alessie and A. Sahakian, "Effects of barriers on propagation of action potentials in two-dimensional cardiac tissue. A computer simulation study," *The Journal of Electrocardiology*, 28(1), pp. 17-31, 1995.
- 45) H.J. Sih, K.M. Ropella, S. Swiryn, E.P. Gerstenfeld and A.V. Sahakian, "Observations from intra-atrial recordings on the termination of atrial fibrillation," *Pace*, 17(7), pp. 1231-1242, 1994.
- 46) C.L. Chan, A.K. Katsaggelos and A.V. Sahakian, "Recursive locally linear motion-compensated image sequence filtering under quantum-limited conditions," *Journal of Visual Communication and Image Representation*, 4(4), pp. 349-363, December, 1993.
- 47) C.L. Chan, A.K. Katsaggelos and A.V. Sahakian, "Image sequence filtering in quantum noise with applications to low-dose fluoroscopy," *IEEE Transactions on Medical Imaging*, 12(3) pp. 610-621, September, 1993.
- 48) E.P. Gerstenfeld, A.V. Sahakian and S. Swiryn, "Evidence for transient linking of atrial excitation during atrial fibrillation in man," *Circulation*, 86, pp. 375-382, 1992.
- 49) A. Sahakian, G. Myers and N. Maglaveras, "Unidirectional block in cardiac fibers: effects of discontinuities in coupling resistance and spatial changes in resting membrane potential in a computer simulation study," *IEEE Transactions on Biomedical Engineering*, 39(5), pp. 510-522, 1992.
- 50) J. Slocum, A. Sahakian and S. Swiryn, "Diagnosis of atrial fibrillation from surface electrocardiograms based on computer-detected atrial activity," *the Journal of Electrocardiology*, 25(1), pp. 1-8, 1992.
- 51) A. Sahakian, K. Ropella and S. Swiryn, "Atrial electrograms and the characterization of atrial fibrillation," *Journal of Electrocardiology*, 24, pp. 131-133, 1991.
- 52) E. Gerstenfeld, A. Sahakian, J. Baerman, K. Ropella and S. Swiryn, "Detection of changes in atrial endocardial activation with use of an orthogonal catheter," *The Journal of the American College of Cardiology*, 18, pp. 1034- 1042, 1991.
- 53) K. Ropella, J. Baerman, A. Sahakian and S. Swiryn "Differentiation of ventricular tachyarrhythmias," *Circulation*, 82, pp. 2035-2043, 1990.
- 54) A. Sahakian, K. Ropella, J. Baerman and S. Swiryn, "Measuring the organization of cardiac rhythms using the magnitude-squared coherence function," *IEEE EMBS magazine*, pp. 25-28, 1990 (invited).
- 55) J. Baerman, K. Ropella, A. Sahakian, J. Kirsh and S. Swiryn, "Effect of bipole configuration on atrial electrograms during atrial fibrillation," *Pace*, 13(1), pp. 78-87, 1990.

- 56) K. Ropella, A. Sahakian, J. Baerman and S. Swiryn, "The coherence spectrum: a quantitative discriminator of fibrillatory and non-fibrillatory cardiac rhythms," *Circulation*, 80: 112-119, 1989.
- 57) J. Kirsh, A. Sahakian, J. Baerman and S. Swiryn, "Ventricular response to atrial fibrillation: role of atrioventricular conduction pathways," *Journal of the American College of Cardiology*, 12(5) pp. 1265-72, 1988.
- 58) N. Maglaveras, A. Sahakian and G. Myers, "Boundary conditions in simulations of cardiac propagating action potentials," *IEEE Trans. Biomed. Eng.* 35(9) pp. 755-758, 1988.
- 59) K. Ropella, A. Sahakian, J. Baerman and S. Swiryn, "Effects of procainamide on intra-atrial electrograms during atrial fibrillation: implications for detection algorithms," *Circulation* 77(5), pp. 1047-1054, 1988.
- 60) J. Slocum, A. Sahakian and S. Swiryn, "Computer discrimination of atrial fibrillation and regular atrial rhythms from intra-atrial electrograms," *Pace*, vol. 11, pp. 610-621, 1988.
- 61) P. Gross, B. Matsumoto, R. Glover and A. Sahakian, "Acoustic apnea monitoring: preliminary results," *The Journal of Clinical Engineering*, 12(6), pp. 433-440, 1987.
- 62) J. Slocum, E. Byrom, L. McCarthy, A. Sahakian and S. Swiryn, "Computer detection of A-V dissociation from surface electrocardiograms during wide-QRS complex tachycardias," *Circulation*, 72(5), 1985, pp. 1028-1036.
- 63) A.V. Sahakian, W.J. Tompkins and J.G. Webster, "Electrode motion artifacts in electrical impedance pneumography," *IEEE Trans. Biomed. Eng.*, BME-32(6), June 1985, pp. 448-451.
- 64) A.V. Sahakian, W.J. Tompkins, B.M. Tompkins and J.F. Kreul, "A microprocessor-based arrhythmia monitor/recorder for the operating and recovery rooms," *Medical Instrumentation*, 17(2), 1983, pp. 131-134.

TEXTBOOK CHAPTERS AND SECTIONS:

- 1) S. Petrutiu, G. Nijm, J. Ng, S. Swiryn and A.V. Sahakian "Time Domain Description of Atrial Fibrillation," in "Atrial Fibrillation, a Signal Processing Perspective" L. Sornmo and S. Cerutti, Eds., Morgan and Claypool, 2008.
- 2) A.V. Sahakian and G.M. Nijm, "Pulse Oximetry and Noninvasive Blood Pressure Recording," in "Practical Signal and Image Processing Concepts for Clinical Cardiology," J. Goldberger and J. Ng, eds., 2009.
- 3) C.L. Chan, A.K. Katsaggelos and A.V. Sahakian, "Techniques in Image Sequence Filtering for Clinical Angiography," in *Medical Imaging Techniques and Applications*, C.T. Leondes, ed., pp. 93-145 (chapter 3), Gordon and Breach Science Publishers, 1997.
- 4) S. Swiryn, A.T. Schoenwald and A.V. Sahakian, "Detection of Atrial Fibrillation by Pacemakers and Antiarrhythmic Devices," in F.D. Murgatroyd and A.J. Camm (eds.)

Nonpharmacological Management of Atrial Fibrillation, Chapter 21, Futura Publishing Co., 1997

- 5) "Adaptive Coherence Estimation on Brief Intracardiac Recordings," in G. Clifford Carter (ed.) Coherence and Time Delay Estimation, IEEE Press (Underwater Acoustics Signal Processing Technical Committee), 1993. (This is a reprint of a paper published earlier.)
- 6) "Input/Output Hardware Design" in W.J. Tompkins and J.G. Webster (eds.) Design of Microcomputer-Based Medical Instrumentation, Prentice Hall, 1981, pp. 208-240. Also Russian edition, 1983.
- 7) "Model Microprocessors" in W.J. Tompkins and J.G. Webster (eds.) Design of Microcomputer-Based Medical Instrumentation, Prentice Hall, 1981, pp. 274- 287. Also Russian edition, 1983.

FULL-LENGTH CONFERENCE PAPERS (*Selected Items*):

- 1) W. Yip, A. Gomes, V. Backman and A. Sahakian, "Polarized Monte Carlo Simulation of Blood Vessel Structure in Colon Tissue," Proceedings of the SPIE, V8230, pp 823012, 2012.
- 2) S-C Kong, A.V. Sahakian, A. Taflove, V. Backman, "High-density Optical Data Storage Enabled by the Photonic Nanojet from a Dielectric Microsphere, Japanese Journal of Applied Physics, 48(3), 2008.
- 3) G.M. Nijm, S. Swiryn, A.C. Larson and A.V. Sahakian, "Estimation of T-Wave Alternans from Multi-Lead ECG Signals Using a Modified Moving Average Method," Proceedings of IEEE Computers in Cardiology Conference, Sept. 2008.
- 4) G.M. Nijm, S. Swiryn, A.C. Larson, A.V. Sahakian, "Evaluation of Image Quality Metrics for Comparison of Synchronization Algorithms for Cardiac Cine MRI," ACCEPTED, TO APPEAR in Proceedings of IEEE International Conference on Image Processing, October 2008.
- 5) G.M. Nijm, S. Swiryn, A.C. Larson and A.V. Sahakian, "Inhomogeneous Human Torso Model of Magnetohydrodynamic Blood Flow Potentials Generated in the MR Environment," TO APPEAR in Proceedings of IEEE Computers in Cardiology Conference, Sept. 2008.
- 6) G.M. Nijm, A.V. Sahakian, S. Swiryn and A.C. Larson, "Comparison of Self-Gating Synchronization Algorithms for Cardiac Cine MRI," Proceedings of Society for Cardiovascular Magnetic Resonance Conference, Feb. 2008.
- 7) Ricke AD, Swiryn S, Sahakian AV, Petrutiu S, Young B, and Rowlandson, GI, "The relationship Between Programmed Pacemaker Pulse Amplitude and Surface ECG recorded Amplitude: Application of a New High Resolution ECG System," Proceedings of the International Society for Computerized Electrocardiography, April 2008.
- 8) G.M. Nijm, S. Swiryn, A.C. Larson and A.V. Sahakian, "A 3D Model of Magnetohydrodynamic Voltages: Comparison with Voltages Observed on the Surface ECG during Cardiac MRI," Proceedings of the IEEE Computers in Cardiology Conference, 2007.

- 9) S. Petrutiu, A. Ricke, A.V. Sahakian, B. Young and S. Swiryn, High Resolution Electrocardiography Optimized for Recording Pulses from Electronic Pacemakers: Evaluation of a New Pacemaker Sensing System,” Proceedings of the IEEE Computers in Cardiology Conference, 2007.
- 10) G.M. Nijm, A.V. Sahakian, S. Swiryn and A.C. Larson, “Comparison of Signal Peak Detection Algorithms for Self-Gated Cardiac Cine MRI,” Proceedings of the IEEE Computers in Cardiology Conference, 2007.
- 11) S. Petrutiu, A.V. Sahakian, W. Fisher and S. Swiryn, “Manifestation of Left Atrial Events in the Surface Electrocardiogram during Atrial Fibrillation,” Proceedings of the IEEE Computers in Cardiology Conference, 2006.
- 12) M.S. Guillem, A.V. Sahakian and S. Swiryn, “Derivation of Orthogonal Leads from the 12-Lead ECG. Accuracy of a Single Transform for the Derivation of Atrial and Ventricular Waves,” Proceedings of the IEEE Computers in Cardiology Conference, 2006.
- 13) G. M. Nijm, S. Swiryn, A.C. Larson and A.V. Sahakian, “Characterization of the Magnetohydrodynamic Effect as a Signal from the Surface Electrocardiogram during Cardiac Magnetic Resonance Imaging, Proceedings of the IEEE Computers in Cardiology Conference, 2006.
- 14) A.V. Sahakian, M. Billeter, G. Nijm and B. Yalvac, “A Laboratory Demonstration of Spatial Encoding in MRI,” Proceedings of the ASEE Conference, 2006.
- 15) A.V. Sahakian, C. Hayes and B. Yalvac, “An inexpensive laboratory module to teach principles of NMR/MRI,” Proceedings of 2005 ASEE Conference, paper 2005-1952, 2005.
- 16) S. Petrutiu, A.V. Sahakian and S. Swiryn, “Dynamics of Fibrillatory Wave Characteristics in the Surface Electrocardiogram at the Onset of Paroxysmal Atrial Fibrillation in Humans,” Proceedings of the Heart Rhythm Society 2006 Annual Meeting.
- 17) Q. Xi, A.V. Sahakian, S. Swiryn, “The influence of QRS cancellation on signal characteristics of atrial fibrillation in the surface electrocardiogram, Proceedings of the IEEE Computers in Cardiology Conference 2004
- 18) S. Petrutiu, A.V. Sahakian and S. Swiryn, “Fibrillatory Wave Analysis of the Surface ECG to Predict Termination of Atrial Fibrillation: The 2004 Computers in Cardiology/PhysioNet Challenge,” Computers in Cardiology, Vol. 31, 2004.
- 19) E.A. Oral and A.V. Sahakian, “3-D Microwave Imaging of Breast Tumors with Matched Filtering,” Proceedings of the 26th Annual Conference of the IEEE EMBS, pp. 1423-1426, 2004.
- 20) Q. Xi, A.V. Sahakian, J. Ng and S. Swiryn, “Stationarity of Surface ECG Atrial Fibrillatory Wave Characteristics in the Time and Frequency Domains in Clinically Stable Patients,” Computers in Cardiology, Vol. 30, pp. 133-136, 2003.
- 21) J. Ng, A.V. Sahakian and S. Swiryn, “Vector Analysis of Atrial Activity from Surface ECGs Recorded During Atrial Fibrillation,” Computers in Cardiology, Vol. 29, pp. 21-24, 2002.

- 22) Q. Xi, A.V. Sahakian and S. Swiryn, "The influence of QRS cancellation on signal characteristics of atrial fibrillation in the surface electrocardiogram," *Computers in Cardiology*, Vol. 29, pp. , 2002.
- 23) J. Ng, A.V. Sahakian and S. Swiryn, "P-wave axis shifts due to body position changes during ambulatory ECG monitoring," *Computers in Cardiology*, Vol. 28, pp. 313-316, 2001.
- 24) S. Shkurovich, A.V. Sahakian, T.V. Votapka, T. Ji and S. Swiryn, "Multisite Dual-Surface Monophasic Action Potential Mapping In Vivo: Further Evidence Of Three-Dimensional Characteristics Of Atrial Repolarization," *Computers in Cardiology* Vol. 27, pp. 99-102, 2000.
- 25) J. Ng, A.V. Sahakian and S. Swiryn, "Sensing And Documentation Of Body Position During Ambulatory ECG Monitoring," *Computers in Cardiology* Vol. 27, pp. 77-80, 2000.
- 26) S. Shkurovich, A.V. Sahakian, T. Ji, T. Votapka, R. Curran, M. Hamer, and S. Swiryn, "A multichannel monophasic action potential electrode array for simultaneous epicardial and endocardial repolarization mapping," *Computers in Cardiology* Vol. 26, pp. 281-284, 1999.
- 27) A.V. Sahakian, M.S.L. Peterson, M. Hamer, T. Votapka, T. Ji, and S. Swiryn, "A simultaneous multichannel monophasic action potential electrode array for epicardial repolarization mapping," *Computers in Cardiology* Vol. 25, pp. 125-128, 1998.
- 28) D.K. Serkland, G.D. Bartolini, P. Kumar, W.L. Kath and A.V. Sahakian, "Rate Doubling of a Highly-Stable Soliton Source," in *Conference on Optical Fiber Communication*, Vol. 6, OSA Technical Digest Series pp. 292-293, 1997.
- 29) S. Shkurovich, A.V. Sahakian and S. Swiryn, "Detection of Atrial Activity from High Voltage Leads of Implantable Ventricular Defibrillators," *Computers in Cardiology* Vol. 23, pp. 77-79, 1996.
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- 32) A.T. Schoenwald, A.V. Sahakian and S. Swiryn, "The distribution of local activation directions during human atrial fibrillation: implications for linking," *Computers in Cardiology* Vol. 21, pp. 785-788, 1994.
- 33) T.J. Kostas, L. Mugnier, A.K. Katsaggelos and A.V. Sahakian, "Super-exponential method for blur identification in radiographic images," *Proceedings of SPIE conference on Visual Communications and Image Processing*, 2308(II), pp. 921-929, 1994.
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- 35) N. Maglaveras, F.J.L. van Capelle, M. Allessie, A.V. Sahakian, C. Pappas and M. Strintzis, "Dispersion of refractoriness and unidirectional block in a model of ischemic myocardium," *Computers in Cardiology* Vol. 20, pp. 663-666, 1993.

- 36) C.L. Chan, J.C. Brailean, A.K. Katsaggelos and A.V. Sahakian, "Maximum a-posteriori displacement field estimation in quantum-limited image sequences," Proc. SPIE Conf. on Visual Communications and Image Processing, pp. 396-407, 1993.
- 37) A.V. Sahakian, "Teaching advanced medical instrumentation in the quarter system: analog and digital signal processing in ten weeks," (invited), proc. ASEE Conf., pp. 1505-1506, 1993.
- 38) N. Maglaveras, F.J.L. Van Capelle, M. Allessie, A.V. Sahakian, C. Pappas and M. Strintzis, "Ischemia effects on propagation characteristics and dispersion of refractoriness in a model of ischemic myocardium," Proc. IEEE EMBS conf., p. 812, 1993.
- 39) C. Chan, A. Katsaggelos and A. Sahakian, "Restoration of low-dosage cine-angiographic sequences using a modified expectation maximization algorithm," Proc. SPIE Conf. on Visual Communications and Image Processing, Vol 1818, pp. 290-298, 1992.
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- 41) N. Maglaveras, F.J.L. VanCapelle, J. DeBakker, M. Allessie, A.V. Sahakian, M. Strintzis and C. Pappas, "Relating tortuosity and extracellular potentials in a two-dimensional model of ventricular myocardium," Proc. IEEE/EMBS conf., 14, pp. 596-597, 1992.
- 42) N. Maglaveras, F.J.L. VanCapelle, M. Allessie, A.V. Sahakian, C. Pappas and M. Strintzis, "Tortuosity effects on longitudinal and transverse plane-wave propagation in a two-dimensional model of ventricular tissue," Computers in Cardiology Vol. 18, pp. 641-644, 1991.
- 43) N. Maglaveras, F.J.L. VanCapelle, M. Allessie, A.V. Sahakian, C. Pappas and M. Strintzis, "Effects of fast-inward current inactivation on propagation in a two-dimensional model of ventricular myocardium," Proc. IEEE/EMBS conf., 13(2), pp. 613-614, 1991.
- 44) C. Chan, B. Sullivan, A. Sahakian, A. Katsaggelos, T. Frohlich and E. Byrom, "Spatio-temporal filtering of digital angiographic image sequences corrupted by quantum mottle," Proc. SPIE/SPSE Symposium on Electronic Imaging, Vol 1450, pp. 208-217, 1991.
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- 47) K.M. Ropella, A.V. Sahakian J.M. Baerman and S. Swiryn, "Coherence estimation from a single-intra-cardiac lead with two electrode elements," Proc. IEEE/EMBS conf., 12(2), pp. 586-587, 1990 (invited)
- 48) K.M. Ropella, S. Swiryn, A.V. Sahakian, H.J. Sih and J.M. Baerman, "Observations on intra-atrial signals during atrial fibrillation in man," Proceedings of the 7'th International Congress, Cardiostim, Nice-French Riviera, 1990.

- 49) B. Kaufman, A.V. Sahakian and J.B. Myklebust, "Analysis of the SEP using the Hilbert Transform," Proc. IEEE/EMBS conf., 12(2), pp. 887-888. 1990.
- 50) N. Maglaveras, A.V. Sahakian, F. VanCapelle, M. Allessie, C. Pappas and M. Strintzis, "Effects of barriers in plane wave propagation in a two- dimensional model of anisotropic cardiac tissue," Proc. IEEE/EMBS conf., 12(4), pp. 1839-1840, 1990.
- 51) S. Swiryn, H. Sih, J. Baerman, T. Frolich and A. Sahakian, "Computer modeling in cardiac electrophysiology," Proc. IEEE/EMBS conf., 12(2), pp. 603-604, 1990 (invited).
- 52) C. Chan, B. Sullivan, A. Sahakian, A. Katsaggelos, S. Swiryn, D. Hueter and T. Frolich "Simulation of Poisson noise in digital angiographic images," Proc. SPIE/SPSE Symposium on Electronic Imaging, Vol 1245, Biomedical Image Processing, pp. 104-110, 1990.
- 53) A.Sahakian, K. Ropella, J. Baerman and S. Swiryn, "Adaptive coherence estimation on brief intracardiac recordings," Proc. IEEE/EMBS 11th ann. conf., pp. 224-225, 1989. (invited)
- 54) K. Ropella, A. Sahakian, J. Baerman and S. Swiryn, "Effect of data segmentation on coherence estimates of cardiac rhythms," Proc. IEEE/EMBS 11th ann. conf., pp. 16-17, 1989. (invited)
- 55) A. Sahakian, K. Ropella, J. Baerman and S. Swiryn, "Median frequency and coherence measures of atrial and ventricular fibrillation," Proc. IEEE/EMBS tenth ann. conf., pp. 16-17, 1988. (invited)
- 56) A.Sahakian, K. Ropella, J. Baerman and S. Swiryn, "Coherence measures of cardiac arrhythmias from intra-cardiac and epicardial leads," Computers in Cardiology Vol. 15, pp. 329-332, 1988.
- 57) A. Sahakian, N. Maglaveras and G. Myers, "Boundary conditions for modeling propagating cardiac action potentials," Proc. IEEE/EMBS ninth ann. conf, pp. 311-312, 1987. (invited)
- 58) J. Slocum, A. Sahakian and S. Swiryn, "Computer detection of atrial fibrillation on the surface electrocardiogram," Computers in Cardiology Vol. 14, pp. 253-254, 1987.
- 59) J. Slocum, A. Sahakian and S. Swiryn, "Characterization of atrial fibrillation," Proceedings of the 1986 Engineering Foundation Conference, (Computerized interpretation of the electrocardiogram XI), pp. 102-105.
- 60) A.V. Sahakian and K.H. Kuo, "Canceling the cardiogenic artifact in impedance pneumography," IEEE Frontiers of Engineering and Computing in Health Care, 1985, pp. 855-859.
- 61) J. Slocum, L. McCarthy, E. Byrom, A. Sahakian and S. Swiryn, "Detection of A-V dissociation in wide-QRS tachycardias," IEEE Frontiers of Engineering and Computing in Health Care, 1985, pp. 762-763.
- 62) J. Slocum, L. McCarthy, E. Byrom, A. Sahakian and S. Swiryn, "Detection of A-V dissociation on the surface ECG," Proceedings of the 1985 Engineering Foundation Conference (Computerized interpretation of the electrocardiogram X), pp. 9-11.

- 63) A.V. Sahakian, W.J. Tompkins and J.G. Webster, "Reducing electrode motion artifacts in electrical impedance pneumography," IEEE Frontiers of Engineering and Computing in Health Care, 1984, pp. 334-336.
- 64) A.V. Sahakian and G.S. Furno, "An adaptive filter for distorted line- frequency noise," Biomedical Sciences Instrumentation, 19, 1983, pp. 47-52.
- 65) A.V. Sahakian and W.J. Tompkins, "A multi-microcomputer-based neonatal apnea monitor," Proceedings of the 10th Annual Northeast Bioengineering Conference, 1982, pp. 151-156.

ABSTRACTS (*Selected Items*):

- 1) Y. Zhang, H.M. al-Angari, Y. Guo, J. Nicolai, R.A.Klein, A. Sahakian, R.A. Omary, A.C. Larson,"MRI and 3D Finite Element Modeling for Prediction of Irreversible Electroporation Ablation Zones: Feasibility Studies in a Rat Tumor Model," Journal of Vascular and Interventional Radiology, V22, Issue 2, pp. S64 (Abstract #146), 2011
- 2) A. Heifetz, K. Huang, A. Sahakian, X. Li, A. Taflove, V. Backman, "Experimental Confirmation of Backscattering Enhancement Induced by a Photonic Jet," American Physical Society, Abstract ID: BAPS.2007.MAR.P38.14, March 2007.
- 3) Grille, H. Polster, E. Buldt, F. Asbeck, S. Shkurovich, A. Sahakian, S. Naik and T. Markowitz, "Atrial sensing performance using a novel VDD lead," Proceedings of Cardiostim 2000 conference, May, 2000.
- 4) A.T. Schoenwald, A.V. Sahakian and S.Swiryn, "Effect of segment length on discrimination of atrial fibrillation by spatial precision of local activation direction," Proceedings of NASPE conference, May, 1996.
- 5) H.J. Sih, A.V. Sahakian, C.E. Arentzen and S. Swiryn, "Epicardial maps of very short wavelength, acetylcholine modulated, swine atrial fibrillation," PACE Pacing and Clinical Electrophysiology, 18 (part II):804, 1995.
- 6) A.T. Schoenwald, A.V. Sahakian, H.J. Sih and S. Swiryn, "Constant direction of multiple episodes of linking during atrial fibrillation: Implications for possible mechanisms," Journal of the American College of Cardiology, February, 1994:1A-484A, p. 444A.
- 7) H.J. Sih, A.V. Sahakian, C.E. Arentzen and S. Swiryn, "Observations from epicardial maps on the termination of atrial fibrillation in a swine model," Journal of the American College of Cardiology, February, 1994:1A-484A, p. 458a.
- 8) S. Swyrin, E.P. Gerstenfeld, H.J. Sih, A. Srinivasan and A. Sahakian, "The organization of atrial fibrillation," The Journal of Electrocardiology, 25:147, 1993.
- 9) H.J. Sih, A.V. Sahakian, C.E. Arentzen and S. Swiryn, "A frequency domain analysis of epicardial maps," PACE, 16:907, 1993.
- 10) H.J. Sih, K.M. Ropella, S. Swiryn, E.P. Gerstenfeld and A.V. Sahakian, "Observations on the termination of atrial fibrillation in humans," Journal of the American College of Cardiology, 16:228A, 1992.

- 11) E.P. Gerstenfeld, A.V. Sahakian and S. Swiryn, "Further observations on the transient linking of atrial excitation during atrial fibrillation in man," *Journal of the American College of Cardiology*, 19:64A, 1992.
- 12) E.P. Gerstenfeld, A.V. Sahakian, J.M. Baerman and S. Swiryn, "Transient "linking" of atrial excitation during atrial fibrillation in man," *PACE*, 14:625, 1991.
- 13) K.M. Ropella, J.M. Baerman, A.V. Sahakian and S. Swiryn, "Differentiation of ventricular tachyarrhythmias for an implantable device," *PACE*, 13:537, 1990.
- 14) E.P. Gerstenfeld, A.V. Sahakian, K.M. Ropella, J.M. Baerman and S. Swiryn, "Discrimination of antegrade from retrograde conduction using an orthogonal catheter," *PACE*, 13:550, 1990.
- 15) J.M. Baerman, K.M. Ropella, A.V. Sahakian, J.A. Kirsh and S. Swiryn, "Effect of bipolar catheter configuration on electrogram morphology during atrial fibrillation," *PACE*, 12:661, 1989.
- 16) J.A. Kirsh, A.V. Sahakian, J.M. Baerman K.M. Ropella and S. Swiryn, "Physiologic significance of electrogram signal characteristics during atrial fibrillation: simulated electrograms in a computer model," *PACE*, 12:657, 1989.
- 17) A. Sahakian, K. Ropella, J. Baerman and S. Swiryn, "Characterization of rhythms from intra-cardiac and epicardial leads using coherence spectra," *the Journal of Electrocardiography*, 22(supplement):231, 1989.
- 18) J.A. Kirsh, A.V. Sahakian, J.M. Baerman and S. Swiryn, "Ventricular response in atrial fibrillation: role of atrioventricular conducting pathways," *PACE*, 11:519, 1988.
- 19) K.M. Ropella, A.V. Sahakian, J.M. Baerman and S. Swiryn, "Discrimination of fibrillatory from non-fibrillatory rhythms: coherence spectra," *PACE*, 11:519, 1988.
- 20) K.M. Ropella, A.V. Sahakian, J.M. Baerman and S. Swiryn, "Effect of procainamide on atrial electrograms during atrial fibrillation: a potential drug-device interaction," *Journal of the American College of Cardiology*, 11:165A, 1988.
- 21) K.Ropella, A. Sahakian and S. Swiryn, "Effect of procainamide on atrial electrograms during atrial fibrillation: a potential drug-device interaction," *Clinical Research*, 35(6):836A, 1987.
- 22) J. Slocum, A. Sahakian and S. Swiryn, "Computer detection of atrial fibrillation on the surface electrocardiogram," *Computers in Cardiology*, 1986, (paper 52).
- 23) A. Sahakian and A. Baur, "Data compression in impedance pneumography," *Proceedings of the ACEMB 39th Annual Meeting*, 1986, p. 225.
- 24) P.G. Gross, B.M. Matsumoto, R.W. Glover and A.V. Sahakian, "Apnea monitoring using lung sounds," *Proceedings of AAMI 21st Annual Meeting*, 1986, p. 33.
- 25) J. Slocum, A. Sahakian and S. Swiryn, "Characterization of atrial fibrillation in the frequency domain," *Circulation*, 72:III-434, 1985.
- 26) A.V. Sahakian and K.H. Kuo, "Canceling the cardiogenic artifact in impedance pneumography," *IEEE Trans. Biomed. Eng.*, BME-32(10), 1985, p. 893.

- 27) J. Slocum, L. McCarthy, E. Byrom, A. Sahakian and S. Swiryn, "Detection of A-V dissociation in wide-QRS tachycardias," IEEE Trans. Biomed. Eng., BME- 32(10), 1985, p. 891.
- 28) J. Slocum, E. Byrom, L. McCarthy, A. Sahakian and S. Swiryn, "Detection of A-V dissociation on the surface ECG," Proceedings of the Engineering Foundation Conference, Santa Barbara, CA, 1985.
- 29) A.V. Sahakian, W.J. Tompkins and J.G. Webster, "Reducing electrode motion artifacts in electrical impedance pneumography," IEEE Trans. Biomed. Eng., BME-31(8), 1984, p. 570.
- 30) W.J. Tompkins, A.V. Sahakian, B.M. Tompkins and J.F. Kreul, "A microprocessor-based arrhythmia monitor/recorder for the operating room," Proceedings of AAMI Annual Meeting, 1980, p. 217.
- 31) W.J. Tompkins, J.G. Webster, A.V. Sahakian, N.V. Thakor and W.C. Mueller, "Long-term, portable, ECG arrhythmia monitoring," Proceedings of AAMI Annual Meeting, 1979, p. 278.

PATENTS:

- 1) European Patent WO/2003/061759 "Methods and Apparatus for Detection and Treatment of Syncope," Granted April 18, 2007.
- 2) U.S. Patent # 6895275 "Methods and apparatus for detection and treatment of syncope," co-inventor with H.T. Markowitz, M.K. Erickson and A. Schuler, issued May 17, 2005.
- 3) U.S. Patent # 6061589 "Microwave antenna for cancer detection system," co-inventor with J.E. Bridges, A. Taflove and S.C. Hagness, Issued May 9, 2000.

TECHNICAL PRESENTATIONS AND SESSIONS CHAIRED (*Selected items*):

2008 – Invited Presentation: "The Incoherent Heart," Illinois Institute of Technology Biomedical Engineering Department, February.

2007 – Invited presentation: "Put a Little Computer in Your Heart: Advances in Implantable Cardiac Pacemakers and Defibrillators," Northwestern University Alumni Continuing Education, May.

2007 – Invited Presentation: "The Incoherent Heart," Center for Photonic Communications and Computing, March.

2006 – Paper Presentation: "A Laboratory Demonstration of Spatial Encoding in MRI, ASEE Conference, Chicago.

2000 – Seminar presentation: "Mapping of cardiac tissue repolarization in-vivo," University of Illinois – Chicago, October.

2000 – Invited paper presentation: “Multi-site monophasic action potential mapping of atrial repolarization in vivo: is atrial repolarization a two or three dimensional process?” International Society for Computerized Electrocardiology, Yosemite, CA, May.

1999 - Invited paper presentation: “Processing signals from the atrium of the heart,” Biomedical Signal Interpretation Workshop, Rosemont, IL, June.

1998 - Paper presentation: “A simultaneous multichannel monophasic action potential electrode array for epicardial repolarization mapping,” IEEE Computers in Cardiology conference, Cleveland, September.

1996 - Seminar presentation: “Applications of DSP in implantable medical devices,” Northern Illinois University, February.

1995 - Seminar presentation: “Applications of digital signal processing in the treatment of the atrial cardiac arrhythmias,” Illinois Institute of Technology, December.

1995 - Invited plenary presentation: “Organization of atrial fibrillation,” International Society for Computerized Electrocardiography Annual conference, Amelia Island Plantation, Fernandina, FL.

1995 - Invited plenary presentation: “Applications of digital signal processing in cardiac pacing,” IEEE Great Lakes Biomedical Engineering Conference, April.

1994 - Invited plenary presentation: “Applications of DSP in understanding, diagnosing and automatically treating atrial cardiac arrhythmias,” IEEE DSP Workshop, Yosemite, CA.

1993 - Paper presentation: “Ischemia effects on propagation characteristics and dispersion of refractoriness in a model of ischemic myocardium,” IEEE/EMBS conference, San Diego.

1991 - Paper presentation: “Effects of fast-inward current inactivation on propagation in a two-dimensional model of ventricular myocardium,” IEEE/EMBS conference, Orlando.

1991 - Invited paper presentation: “Atrial electrograms and the characterization of atrial fibrillation,” International Society for Computerized Electrocardiology, Santa Barbara.

1990 - Invited paper presentation: “Coherence estimation from a single- intra-cardiac lead with two electrode elements,” IEEE/EMBS conference, Philadelphia.

1989 - Invited paper presentation: “Adaptive coherence estimation on brief intracardiac recordings,” IEEE/EMBS conference, Seattle.

1989 - Invited paper presentation: “Characterization of rhythms from intra- cardiac and epicardial leads using coherence spectra,” Conference of the International Society for Computerized Electrocardiography, Santa Barbara, CA, April.

1988 - Paper presentation: “Coherence measures of cardiac arrhythmias from intra-cardiac and epicardial leads,” IEEE Computers in Cardiology conference, Bethesda, MD.

1987 - Invited paper presentation: “Active boundary conditions for modeling propagating cardiac action potentials,” IEEE/EMBS conference Boston.

1986 - Paper presentation: “Data compression in impedance pneumography,” 39th ACEMB conf. Baltimore.

1985 - Invited tutorial session: “Design, analysis, and realization of elementary digital filters.” IEEE-EMBS/ACEMB annual conference, Chicago.

1985 - Paper presentation: "Canceling the cardiogenic artifact in impedance pneumography." IEEE/EMBS conference, Chicago.

1983 - Paper presentation: "An adaptive filter for distorted line-frequency noise." Association for the Advancement of Medical Instrumentation Annual Meeting, Mayo Clinic, Rochester.

1983 - Lecture: "Adaptive and feature filtering." University of Wisconsin - Extension, Madison.

CHAIRMANSHIPS AT INTERNATIONAL CONFERENCES (*selected items*)

2006 – Session Chair: Bringing Modern technology into Biomedical Engineering, BMES Conference, Chicago.

2004 – Co-chairman, Plenary Session, IEEE Computers in Cardiology Conference, Chicago.

1999 - Co-chairman, Mapping Biosignals Session, Biosignal Interpretation Workshop, Chicago.

1996 - Chairman, Physiological Data Acquisition Systems Session, IEEE EMBS Conference, Amsterdam.

1996 - Chairman, ECG Signal Processing Session, IEEE Computers in Cardiology Conference, Indianapolis.

1994 - Chairman, Instrumentation track, (Technical Program Committee) IEEE EMBS Conference, Baltimore.

1992 - Co-chairman, Intelligent Sensors and Transducers track, IEEE EMBS Conference, Paris.

1991 - Chairman, Instrumentation track, (Technical Program Committee) IEEE/EMBS Conference, Orlando.

1991 - Chairman, Clinical and Diagnostic Instrumentation Session, IEEE/EMBS Conference, Orlando.

1991 - Co-Chairman, Electrocardiography II session, IEEE/EMBS conference, Orlando.

1990 - Chairman, Neural Networks session, IEEE Computers in Cardiology Conf., Chicago.

1990 - Chairman, Instrumentation track, IEEE/EMBS Conf., Philadelphia.

1990 - Chairman, Cardiovascular Instrumentation session, IEEE/EMBS Conf., Philadelphia.

1989 - Chairman, Instrumentation track, IEEE/EMBS Conf., Seattle.

1989 - Chairman, Diagnostic Instrumentation session, IEEE/EMBS Conf., Seattle.

1987 - Chairman, Modeling and Simulation session, IEEE/EMBS conf. Boston.

1986 - Chairman, Medical Instrumentation Session, 39th ACEMB conf. Baltimore.

SCIENTIFIC AND PROFESSIONAL SOCIETY MEMBERSHIPS:

IEEE (Fellow) and IEEE Engineering in Medicine and Biology Society, Microwave Theory and Techniques Society, Antennas and Propagation Society.

American Society for Engineering Education (member and Northwestern University campus representative).

POSITIONS WITHIN PROFESSIONAL SOCIETIES

IEEE: Distinguished Lecturer, EMBS (1993-2011).

Fellows Committee, IEEE EMBS (2003-2005 and 2006-2007)

Advisory Board: IEEE Transactions on Information Technology in Biomedicine (1998-2011)

Steering Committee, IEEE Transactions on Medical Imaging (1998 through 2000)

Vice President for Publications and Technical Activities of the Engineering in Medicine and Biology Society (EMBS) (1996 and 1997/1998 terms)

Region-4 (north-central US) Administrative Committee (AdCom) representative for EMBS (1993/95 and 95/97 terms)

Chairman, Emerging Technologies Committee, EMBS (1993 through 1995).

Chairman, Publications Committee, EMBS (1996 through 1998)

Member and Chapter Activities Committee, EMBS (1993 through 1997).

Student activities committee, EMBS (1993 through 1997).

Biomedical Engineering Society:

Editorial Board, Instrumentation section, for the Annals of Biomedical Engineering, (1990-93).

Recent reviewer for:

IEEE Transactions on Biomedical Engineering, IEEE Transactions on Medical Imaging, IEEE Transactions on Information Technology in Biomedicine, Annals of Biomedical Engineering, Medical and Biological Engineering and Computing, Circulation, Biotechnology Progress, Medical and Biological Engineering and Computing.

TEACHING AWARDS / CHAIRS

Charles Deering McCormick Chaired Professorship in Teaching Excellence, 1999-2002.

Associated Student Government (ASG) faculty honor roll for years 1996, 1997, and 2002.

McCormick School of Engineering and Applied Science Advisor of the Year Award, 1995-96.

Bette and Neison Harris Chaired Professorship in Teaching Excellence, 1993-95.

Northwestern University Alumni Association: Award for Teaching Excellence, 1992.

McCormick School of Engineering and Applied Science Award for Teaching Excellence, 1990.

McCormick School of Engineering and Applied Science Teaching Honor Roll, 1990.

OTHER HONORS/AWARDS:

2011: Elected a Fellow of AIMBE “For contributions to electrophysiology of atrial cardiac arrhythmias”

2007: Elected a Fellow of IEEE “For contributions to electrophysiology of atrial cardiac arrhythmias”

1996: Distinguished Alumnus and Outstanding Achievement Awards, University of Wisconsin - Parkside.

1995: Outstanding IEEE Student Branch Advisor, Region-4.

RESEARCH SUPPORT:

CURRENT:

From the NIH: “MRI for In-Vivo Quantification of Y-90 Microspheres” (F-31 with Oyenlolu Adeyanju).

From the Defense Intelligence Agency (subcontract from Argonne National Labs), Remote detection of intent, co-pi at NU.

COMPLETED:

From the Department of Defense, “Nanoparticle Contrast Agents for Enhanced Microwave Imaging and Thermal Treatment of Breast Cancer” \$506,537, September, 2007 – October, 2009, Co-investigator with Xu Li as PI.

From Honeywell, Inc. (through Segal Design Institute), SafeCar vehicle for first-responders (undergrad research/design).

From the Dr. Scholl Foundation, “Mechanisms of Atrial Fibrillation, a Study Focusing on Issues of Repolarization,” Cumulative: \$342,600 through 11/2009, Co-PI with Steven Swiryn.

From the National Science Foundation through the VaNTH Center: “A module teaching principles of Cardiovascular Signal Processing,” and “A module teaching principles of magnetic resonance imaging using a bench-top instrument” Approx. \$250,000, through 8/2007.

From Medtronic, Inc., “Signal processing for implantable cardiac pacemakers” Cumulative: \$281,000, through 10/2007.

From the Defense Advanced Research Project Agency (DARPA), “Lightweight cryptographic techniques,” Co-PI with Horace Yuen and Majid Sarrafzadeh, \$967,043, 6/1/00 – 5/01/03.

From the O’Shaughnessy Foundation, “Instrumentation to correlate body position with cardiac arrhythmias in ambulatory patients,” \$25,000, (co-investigator with S. Swiryn), 12/1/99 through 11/30/00.

From AT+T/Lucent Technologies, Special Purpose Grant to Establish a Multidisciplinary Laboratory for the Development of Technology for Optical Video Networks, \$65,000, (with P. Kumar and A. Katsaggelos as co-PI's), 11/96 through 10/97.

From the NIH, "Microwave Breast Cancer Detection," (SBIR grant subcontract from Interstitial, Inc, with J. Bridges and A. Taflove), 6/96 through 7/97.

From the Federal Aviation Administration, "Image Processing for Radiographic Inspection" through the Center for Aviation Systems Reliability, Iowa State University, \$120,000, 9/90 through 2/95.

From Siemens: "Processing enhancements for digital angiographic image sequences," (with A. Katsaggelos as co-investigator), \$276,827, 12/1/89 through 12/31/92.

From Siemens: Photoelectron-statistic-limited X- ray angiography, (with A. Katsaggelos and B. Sullivan as co-investigators), \$18,000, 5/1/89 through 11/30/89.

From the Microelectronics Systems Center: "Multi-processor for modeling complex two-dimensional arrays in matrix representations," \$2,500, 10/1/88 - 9/30/89.

From Evanston Hospital "Atrial fibrillation: studies from atrial electrograms," (co-investigator with S. Swiryn), \$32,598, 12/1/87 through 11/30/88.

From Cardiac Pacemakers, Inc. (St. Paul, MN) "Conversion of atrial fibrillation using low-energy intra-atrial countershocks," (co-investigator with J.M. Baerman), \$10,000, 10/1/87 through 12/31/87.

From University Research Grants Committee: "Algorithm studies for long-term neonatal apnea monitoring," \$2,000, 6/1/85 through 5/31/86.

GRADUATE STUDENT ADVISEES:

ADVISEES HAVING COMPLETED DEGREES:

Janet Slocum (Ph.D. EE completed 5/86). Thesis title: "Computer detection of A-V dissociation and atrial fibrillation."

Albrecht Baur (M.S. EE completed 8/85). Project title: "Data compression of the impedance pneumogram."

Kuo-Hua Kuo (M.S. EE completed 12/85). Project title: "A software package for the acquisition and analysis of the impedance pneumogram."

Brian Matsumoto (M.S. BME completed 8/87) Thesis title: "Instrumentation for the acquisition and analysis of heart-rate variability data."

Nicos Maglaveras (Ph.D. EE completed 10/87) Thesis title: "Computer modeling of propagating cardiac action potentials in one and two dimensional tissue using finite elements."

James Varelis (M.S. BME completed 6/87) Thesis title: "On the relationship between potential and impedance motion artifacts in silver/silver chloride surface electrodes."

Jacob Weinrib (M.S. CS completed 1/87) Project title: "Evaluation of a significant-point extraction algorithm for ECG data compression."

Hala Medawar (M.S. EE completed 12/87) Project title: "Design of a pulse oximeter."

Kristina Ropella (nee Piacsek) (M.S. BME completed 6/87) Thesis title: "The effects of procainamide on intra-atrial electrograms during atrial

fibrillation," (Ph.D. BME completed 11/89) Thesis title: "Bivariate analysis of cardiac rhythms,"

Joel Kirsh (M.S. BME completed 6/88) Thesis title: "Ventricular response to atrial fibrillation: role of atrioventricular conduction pathways."

Wei-Dee Hsiao (M.S. EE completed 12/88) Project title: "Theoretical and experimental studies for improved pulse oximetry."

David Zung (M.S. EE completed 12/88) Project title: "Design and implementation of a pulse oximeter utilizing a pseudo-random binary sequence generator."

Pamela Gross, M.D. (Ph.D. BME completed 6/89) Thesis title: "The use of a piezoelectric polymer transducer to study the frequency partition of chest wall sounds."

Bernice Kauffman (M.S. BME completed 9/89) Thesis title: "An automated investigation of somatosensory evoked potential evaluation in cervical spondylosis myelopathy."

Ibrahim Ajami (M.S. EE completed 12/89) Project title: "Detection of A-V dissociation in wide-QRS-complex tachycardias using median-event cancellation and Hilbert-transformed autocorrelation analysis."

Haris Sih (M.S. EE completed 12/90) Thesis title: "Effects of uniform anisotropy on wavelet fractionation and effects of refractoriness dispersion on electrogram calculations in a computer model of a fibrillating cardiac tissue sheet." (Ph.D. EE Completed 12/94) Thesis title: Coherence mapping of cardiac tissue and its application to atrial fibrillation.

Seung-Jae Lee (M.S. EE completed 6/92) Thesis title: "A computer model of radiographic image formation." (Ph.D. EE completed 12/97) Thesis title: Resolution enhancement of image sequence using motion-compensated sub-pixel registration and interpolation.

Mary Sue Reinert (M.S. EE completed 12/92) Thesis title: "A comparison of three techniques for magnitude-squared coherence estimation of simulated data and cardiac electrograms."

Edward Gerstenfeld, MD, (M.S. BME completed 6/93), "Detection of patterns in atrial endocardial activation during sinus rhythm, retrograde conduction, and atrial fibrillation with use of an orthogonal catheter."

Akila Srinivasan (M.S. BME completed 5/93), "Intra-atrial electrograms in comparison with respiratory activity and surface electrocardiograms during atrial fibrillation."

Cheuk Chan (Ph.D. EE Completed 7/93) "Image sequence filtering and displacement field estimation under quantum-limited imaging conditions."

Daniel Levy (M.S. CS Completed 6/94) Thesis title: A Unix/Dos disk sharing system.

Kok-Hwee Ng (Ph.D. BME Completed 12/94) Thesis title: Arterial tissue characterization by intravascular ultrasound radio frequency signal analysis.

Adam Schoenwald (M.S. BME Completed 12/94) Thesis title: Observations on linking of atrial activation from long-term three-dimensional endocardial recordings during atrial fibrillation.

Stephanie Shors (M.S. BME Completed 5/95) Thesis title: A method for determining high-resolution activation time delays in atrial myocardium.

Irfan Lateef (M.S. BME Completed 5/96) Thesis title: Validation of a multi-site monophasic action potential mapping electrode array.

Sergio Shkurovich (M.S. BME completed 11/96) Thesis title: Detection of atrial activity from high-voltage leads of implantable cardioverter defibrillators using a cancellation technique.

Ming-Shing Lee-Peterson (M.S. BME completed 6/97) Thesis title: A simultaneous multi-channel monophasic action potential electrode array for epicardial repolarization mapping.

Mingchun Li (M.S. ECE completed 12/99) (Non-thesis degree)

Sergio Shkurovich (Ph.D. BME completed 6/2001) Thesis title: Monophasic action potential mapping of atrial repolarization.

Andreas Schuler (M.S. ECE completed 6/2001) Thesis title:

Jason Ng (M.S. ECE Completed 6/2001) Thesis title: Sensing and documentation of body position during ambulatory ecg monitoring.

Qin (Cecilia) Xi (Ph.D. BME completed 9/2003) Thesis title: Analyzing atrial activity in surface electrocardiograms to determine mechanisms of atrial fibrillation and flutter.

Emin Oral (Ph.D. ECE completed 6/2004) Thesis title: A computational study of reconstruction algorithms for ultra-wideband electromagnetic pulse imaging in tissue

Jason Ng (M.S. ECE , Ph.D. ECE completed 6/2004) Thesis title: Multidimensional analysis of atrial fibrillation and flutter

Brian Craig (non-thesis M.S. BME completed June 2004)

Chris Hayes (non-thesis M.S. BME completed June 2004)

Amit Sharma (non-thesis M.S. BME completed August 2004)

Marisa Ruffolo (Ph.D. ECE completed 6/2005) Thesis title: The development of storage requirements and the analysis of optimal storage placement for a federated digital medical imaging network.

Haitham al Angari (Ph.D. ECE completed 12/05) Thesis title: Studies of the Cardiorespiratory Interaction in Obstructive Sleep Apnea Syndrome (OSAS).

Maria Guillem de la salud Sanchez (non-thesis M.S. BME completed 6/06) (Fulbright Fellow from Universidad Polytechnica de Valencia Spain)

Markus Billeter (Visiting Scholar) Master of Science in Electrical Engineering and Information Technology, Eidgenossusche Technische Hochschule Zurich, Thesis title: Laboratory Demonstration of Spatial Encoding in MRI.

Grace M. Nijm (M.S. ECE completed 6/06) Thesis title: Characterization of the Magnetohydrodynamic Effect in the Surface ECG during MRI.

Simona Petrutiu (Ph.D. ECE completed 6/08) Thesis title: Frequency Domain Analysis of the Surface Electrocardiogram and Intracardiac Electrograms: Insights into the Mechanisms of Atrial Fibrillation

Grace M. Nijm (Ph.D. ECE completed June 2009)

Jonathon Koenig (M.S. ECE completed June 2010) Thesis Title: "Observations of pacemaker Pulses in High Bandwidth Electrocardiograms and Dower-estimated Vectorcardiograms"

CURRENT GRADUATE STUDENTS:

Ilya Mikheson (Ph.D. in ECE expected June 2014)

Oyenlolu Adeyanju (Ph.D. BME expected June 2014)

TEACHING AND COMMITTEE ACTIVITIES AT NORTHWESTERN UNIVERSITY:

COURSES TAUGHT AND CTEC INSTRUCTOR EVALUATIONS:

QTR	NUMBER	TITLE	SIZE	TA	CTEC
1/84-85	EECS C16	Mini/microcomputer systems and real-time applications	35	labs	3.4/4.0
2/84-85	EECS C53	Digital electronic circuits and systems	12	labs	3.9/4.0
3/84-85	EECS C77	Biomedical computing	19	no	3.9/4.0
1/85-86	EECS C16	Mini/microcomputer systems and real-time applications	29	labs	3.3/4.0
2/85-86	EECS C53	Digital electronic circuits and systems	15	yes	3.5/4.0
3/85-86	EECS C46	Microprocessor systems design	15	no	4.0/4.0
3/85-86	EECS C77	Biomedical computing	12	no	3.9/4.0
1/86-87	EECS C16	Mini/microcomputer systems and real-time applications	20	labs	3.3/4.0
2/86-87	EECS C53	Digital electronic circuits and systems	38	yes	3.6/4.0
3/86-87	EECS C46	Microprocessor systems design	28	yes	3.9/4.0
3/86-87	EECS C77	Biomedical computing	10	no	3.9/4.0
1/87-88	EECS C16	Mini/microcomputer systems and real-time applications	24	labs	3.5/4.0
1/87-88	EECS C53	Digital electronic circuits and systems	62	yes	3.6/4.0
2/87-88	EECS B01	Fundamentals of computer organization	40	yes	3.7/4.0
3/87-88	EECS C77	Biomedical computing	17	no	3.9/4.0
1/88-89	EECS B05	Systems software (assembly language)	24	yes	3.5/4.0
1/88-89	EECS C53	Digital electronic circuits and systems	20	yes	3.4/4.0
2/88-89	EECS B05	Systems software (assembly language)	41	yes	3.8/4.0
3/88-89	EECS C16	Mini/microcomputer systems and real-time applications	25	yes	3.9/4.0
1/89-90	EECS B05	Systems software (assembly language)	41	yes	3.6/4.0

1/89-90	EECS C53	Digital electronic circuits and systems	22	yes	3.8/4.0
2/89-90	EECS B05	Systems software (assembly language)	36	yes	3.6/4.0
3/89-90	EECS C53	Digital electronic circuits and systems.	34	labs	3.6/4.0
3/89-90	EECS C77	Biomedical computing	18	no	3.9/4.0
1/90-91	EECS B05	Systems software (assembly language)	44	yes	3.8/4.0
1/90-91	EECS C53	Digital electronic circuits and systems	17	yes	3.8/4.0
2/90-91	BME C95-24	Cardiovascular instrumentation	8	no	4.0/4.0
3/90-91	EECS C77	Biomedical computing	10	no	4.0/4.0
1/91-92	EECS C53	Digital electronic circuits and systems	14	labs	3.8/4.0
2/91-92	BME C95-23	Cardiovascular instrumentation	2	no(exempt)	
3/91-92	EECS C53	Digital electronic circuits and systems.	27	yes	4.0/4.0
3/91-92	BME C95-21	Advanced biomedical instrumentation	5	yes	4.0/4.0
1/92-93	EECS C53	Digital electronic circuits and systems	14	labs	3.9/4.0
2/92-93	BME C83	Cardiovascular instrumentation	10	no	3.9/4.0
3/92-93	EECS C53	Digital electronic circuits and systems	19	labs	3.6/4.0
3/92-93	BME C95	Advanced biomedical instrumentation	5	yes	4.0 /4.0
1/93-94	EECS C53	Digital electronic circuits and systems	23	labs	3.8/4.0
2/93-94	BME C83	Cardiovascular instrumentation	7	no	3.8/4.0
3/93-94	EECS B01	Fundamentals of computer organization	52	yes	3.9/4.0
3/93-94	EECS A40	Introduction to EECS	14	no	3.8/4.0
2/94-95	BME C83	Cardiovascular Instrumentation	18	yes	4.0/4.0
3/94-95	EECS C53	Digital electronic circuits and systems	27	yes	3.6/4.0
1/95-96	EECS C53	Digital electronic circuits and systems	15	labs	3.6/4.0
2/95-96	BME C83	Cardiovascular Instrumentation	16	yes	3.7/4.0
3/95-96	CAS C80-7	American Sign Language and Deaf culture – I	18	co-taught	exempt
3/95-96	EECS C06	Electronic Circuits	16	yes	3.9/4.0
3/95/96	BME C95	Advanced Biomedical Instrumentation	11	yes	3.9/4.0
1/96-97	ECE C53	Digital electronic circuits and systems	22	yes	5.31/6.0
1/96-97	CAS C80-7	American Sign Language and Deaf culture – II	10	co-taught	exempt
2/96-97	BME C83	Cardiovascular Instrumentation	15	no	5.38/6.0
2/96-97	CAS C80-7	American Sign Language and Deaf culture – III	7	co-taught	exempt
3/96-97	ECE C53	Digital electronic circuits and systems	23	yes	5.44/6.0
3/96-97	BME C84	Biomedical Computing	7	yes	5.67/6.0
2/97-98	ECE C53	Digital electronic circuits and systems	20	yes	4.88/6.0
2/97-98	BME C83	Cardiovascular Instrumentation	9	no	5.50/6.0
3/97-98	ECE C53	Digital electronic circuits and systems	20	yes	5.58/6.0
3/97-98	BME C84	Biomedical Computing	14	no	5.27/6.0

1/98-99 BME C25	Introduction to Medical Imaging	18	yes5.17/6.0
2/98-99 ECE C53	Digital Microelectronics	29	yes5.52/6.0
2/98-99 BME C83	Cardiovascular Instrumentation	14	no 5.38/6.0
2/98-99 GTK A06-1	Engineering Design and Communication	14	co-taught exempt
3/98-99 ECE C53	Digital Microelectronics	14	yes5.45/6.0
3/98-99 GTK A06-2	Engineering Design and Communication	15	co-taught exempt
1/99-00 BME C25	Introduction to Medical Imaging	23	yes5.10/6.0
2/99-00 ECE 202	Introduction to Electrical Engineering	54	yes4.70/6.0
2/99-00 BME 383	Cardiovascular Instrumentation	11	no 5.64/6.0
3/99-00 ECE 353	Digital Microelectronics	33	yes5.20/6.0
1/00-01 ECE 202	Introduction to Electrical Engineering	70	yes4.57/6.0
1/00-01 BME 325	Introduction to Medical Imaging	19	yes5.33/6.0
2/00-01 BME 383	Cardiovascular Instrumentation	12	yes5.22/6.0
3/00-01 ECE 353	Digital Microelectronics	26	yes5.20/6.0
1/01-02 BME 325	Introduction to Medical Imaging	13	yes5.67/6.0
1/01-02 ECE 202	Introduction to Electrical Engineering	71	yes 4.0/6.0
2/01-02 BME 383	Cardiovascular Instrumentation	24	yes 5.5/6.0
3/01-02 ECE 353	Digital Microelectronics	20	Yes 5.9/6.0
1/02-03 BME 325	Introduction to Medical Imaging	21	No 5.4/6.0
2/02-03 BME 383	Cardiovascular Instrumentation	21	Yes 5.6/6.0
3/02-03 ECE 353	Digital Microelectronics	29	Yes 5.7/6.0
1/03-04 BME 325	Introduction to Medical Imaging	17	No 5.6/6.0
2/03-04 BME 383	Cardiovascular Instrumentation	20	No 5.7/6.0
3/03-04 ECE 353	Digital Microelectronics	33	Yes 5.5/6.0
1/04-05 BME 325	Introduction to Medical Imaging	26	Yes 5.4/6.0
2/04-05 BME 383	Cardiovascular Instrumentation	22	Yes 5.7/6.0
3/04-05 ECE 353	Digital Microelectronics	26	Yes 5.4/6.0
1/05-06 BME 325	Introduction to Medical Imaging	26	Yes 5.5/6.0
2/05-06 BME 383	Cardiovascular Instrumentation	25	Yes 5.4/6.0
3/05-06 ECE 353	Digital Microelectronics	20	Yes 5.3/6.0
1/06-07 BME 325	Introduction to Medical Imaging	32	Yes 5.4/6.0
2/06-07 BME 383	Cardiovascular Instrumentation	19	Yes 5.5/6.0
3/06-07 ECE 353	Digital Microelectronics	15	Yes 5.6/6.0
1/07-08 BME 325	Introduction to Medical Imaging	27	Yes 5.8/6.0
2/07-08 BME 383	Cardiovascular Instrumentation	24	Yes 5.5/6.0
3/07-08 EECS 353	Digital Microelectronics	20	No 5.4/6.0
1/08-09 BME 325	Introduction to Medical Imaging		

2/08-09 EECS 395/495	Cardiovascular Instrumentation
3/08-09 EECS 353	Digital Microelectronics
1/09-10 BME 325	Introduction to Medical Imaging
2/09-10 EECS 395/495	Cardiovascular Instrumentation
3/09-10 EECS 353	Digital Microelectronics

COMMITTEES AND SERVICES AT NORTHWESTERN UNIVERSITY:

2007-2010	General Faculty Committee Representative for the McCormick School of Engineering and Applied Science
2007-present	Northwestern Center for Engineering Education Research
2001-present	Board of Directors for Motorola Center for Seamless Communications
2000-present	Northwestern Conciliation Council
1999-present	Fellow of the Searle Center for Teaching Excellence
1997-present	McCormick Co-operative Education Steering Committee
1997-2003	Northwestern Community Council (NCC)
1997-1999	Executive Board, University Faculty Reappointment, Promotion and Tenure-Denial Appeal Panel (UFRPTDAP)
1995-2000	Master of the Lindgren Residential College of Science and Engineering
1994-2001	Northwestern University delegate to American Association for Higher Education (AAHE) project on peer evaluation of teaching
1993-1999	Steering Committee for Searle Center for Teaching Excellence
1993-1994	McCormick Committee on our Future
1993-1995	McCormick Committee on Excellence
1993-1995 and	Elected Member, UFRPTDAP
1996-1998	
1992-1993	Chairman of McCormick Teaching and Advising Awards Committee
1991-1998	Chairman of EE Curriculum Committee
1991-present	Faculty co-advisor, McCormick Design Competition
1991-1995	Faculty Associate to the Lindgren Residential College of Science and Engineering
1990-1998	EE Dept. representative on McCormick Curriculum Committee
1986-present	Honors Program in Medical Education (seven-year BS/MD) Admissions Committee (alternating years)

1986-1998	EE Laboratory Budget Committee
1986-present	BME Undergraduate Curriculum Committee
1986-present	IEEE student branch counselor and advisor
1985-1987	EE Ph.D. Qualifying Examination Committee
1985-present	Faculty advisor or co-advisor to N.U. Amateur Radio Society (W9BGX)
1984-1991	EE Program Committee

OTHER COMMITTEES:

2002-2004	Organizing Committee for the 2004 Computers in Cardiology Conference
1995-2001	Steering Committee for the Chicago Section IEEE EMBS
1995-1997	Organizing Committee for the 1997 EMBS conference
1998-1999	Publications co-chair for 1999 IEEE Biosignal Interpretation Workshop