Sridhar Ramakrishnan

Doctorate Student 2009
Nondestructive Evaluation Laboratory
Michigan State University
1618 Spartan Vlg Apt I
East Lansing, MI 48823, USA

Phone: +1(517) 303-1335
Email: rsridhar@egr.msu.edu
Web: http://www.egr.msu.edu/~rsridhar

Summary

- ***Research Interests***
  - Array Signal Processing, Detection & Estimation Theory, Time-Frequency Distributions, Image Processing, Pattern Recognition, Inverse Problems
  - Biomedical Signal Analysis, Noninvasive patient monitoring systems – Auscultation, ECG
  - Acoustics, Elastodynamics, Numerical Modeling – FDTD, FEM
  - Nondestructive Testing
- ***Education***
  - PhD – Michigan State University – Electrical Engineering – 2009 (expected)
  - MS – Iowa State University – Electrical Engineering – 2002
  - BTech – University of Mumbai (VJTI) – Electrical Engineering – 2000
- ***Research Experience***
  - 2002 – Present: Graduate Research Assistant, Nondestructive Evaluation Laboratory (NDEL), Michigan State University – Contributed in 6 research projects
  - 2000 – 2002: Graduate Research Assistant, Materials Assessment Research Group (MARG), Iowa State University – Contributed in 2 research projects
- ***Publications***
  - 6 Peer-Reviewed Journal Papers
  - 11 Peer-Reviewed Conference Papers
  - 6 Presentations / Talks
- ***Other Skills***
  - Experienced in developing graphical user interfaces in Matlab. Good presentation skills.
  - Strong work ethics, good leadership qualities and interpersonal skills, motivational team player.

Education

Ph.D., *Electrical Engineering*	Michigan State University, East Lansing, MI 48823, USA GPA: 3.85/4.00 Advisor: Dr. Satish Udpa Dissertation Topic: *A Viscoelastic Finite Difference Time Domain (FDTD) model of the human thorax to develop and validate Source Localization algorithms*	Aug 2002 – Aug 2009
M.S., *Electrical Engineering*	Iowa State University, Ames, IA 50011, USA GPA: 3.72/4.00 Advisor: Dr. Satish Udpa Thesis Topic: *Detection of an outlet strut fracture in a prosthetic heart valve using an Electromagnetic Acoustic Transduction (EMAT) Technique*	Aug 2000 – Dec 2002
B.Tech., *Electrical Engineering*	University of Mumbai, Mumbai, INDIA. First Class 66.5% Advisor: Dr. N. K. Jog Final Project: *Imaging techniques for the diagnosis of diseases*	Jun 1996 – May 2000

Research Experience

PhD Dissertation *(Jan 2006 - Present)*

- *A Viscoelastic Finite Difference Time Domain (FDTD) model of the human thorax to develop and validate Source Localization algorithms*
  - Developed a FDTD numerical model to simulate the sound propagation in the human thorax.
  - Studied and compared various source localization schemes to localize intra-thoracic sound sources.
  - Developed a Matlab GUI to allow an interactive study of performance of the algorithms with changing parameters.
  - Presented work at the First International Symposium on Audible Acoustics for Medicine and Physiology, Sept 2008.
  - Tools & Technologies: FDTD numerical scheme, Source Localization algorithms, Matlab.

Masters Thesis *(Aug 2001 – Dec 2002)*

- *Detection of an outlet strut fracture in a prosthetic heart valve using an Electromagnetic Acoustic Transduction (EMAT) Technique*
  - Designed and built a 3x3 acoustic chest pad using electronic stethoscopes to record thoracic sounds.
  - Simulated, tested and compared three different adaptive beamforming techniques to localize the heart valve source.
  - Tools & Technologies: Electronic Stethoscope, 16 channel simultaneous sampling A/D system, Flock of Birds position tracker, Beamforming algorithms, Matlab.

Projects worked on as a Graduate Research Assistant *(Aug 2000 – Present)*

- *Noninvasive acoustic characterization of heart and lung pathologies using array sensor processing – Funded by SenX Technology* (2008)
  - Compared and tested various acoustic sensors – contact microphones, piezo transducers and electronic stethoscopes.
  - Developed a simultaneous sampling multi-channel unit for recording heart and lung sounds.
  - Designing source localization algorithms to enhance the heart and lung sounds while reducing noise interference.

- *Noninvasive methods of detecting fractures in prosthetic heart valves – Funded by Pfizer* (2002-2006)
  - Electromagnetic Acoustic Transduction (EMAT) Technique
    - Designed and built electromagnets, RLC resonance circuit, PID controller to control the flux field levels.
    - A Laser Doppler Vibrometer was used for measuring the acoustic vibrations of the heart valve.
    - Developed adaptive filtering and feature extraction algorithms to determine the structural integrity of the valve.
  - Passive Auscultation Technique
    - A pulse duplicator unit was installed to mimic the cardiovascular system.
    - Recorded the heart valve sounds using an electronic stethoscope. Developed cluster-based classification algorithms.
  - Tools & Technologies: Laser Doppler Vibrometer, Electronic Stethoscope, Classification algorithms, Matlab.

- *Noninvasive diagnosis of Gastro-Esophageal Reflux Disease (GERD) in pre-term infants – Collaboration with Sparrow Hospital* (2005-2006)
  - Analyzed swallow sounds of pre-term infants. Determined patterns in signals characterizing GERD patients. Developed automated diagnostic algorithms to detect these patterns.

- *Noninvasive methods for assessing structural integrity of foam used in space shuttles – Funded by NASA* (2004-2005)
  - Analyzed Terahertz Images of the SOFI foam and developed automated wavelet-based processing and classification algorithms to detect delaminations and voids.

- *Automated analysis of Eddy Current Data obtained from steam generator tubes – Funded by EPRI* (2000-2009)
  - Analyzed eddy current data acquired from steam generator tubes and developed automated signal processing, feature extraction and classification algorithms to detect tube degradation mechanisms.
  - Developed Matlab and Visual C++ graphical user interface and software, *AutoAnalysis © EPRI*.

- *Course Projects* (2000-2008)
  - FDTD methods for Viscoelastic Wave Propagation, Detection of Ventricular Arrhythmia, Forward and Inverse Problems of Electrocardiography, Fingerprint Recognition, Source Localization techniques

Research Interest

- Array Signal Processing, Detection & Estimation Theory
- Time-Frequency Distributions, Image Processing, Pattern Recognition
- Noninvasive patient monitoring systems – Auscultation, ECG
- Acoustics, Elastodynamics, Numerical Modeling – FDTD, FEM
- Human Physiology, Biomedical Signal Analysis
- Inverse Problems, Linear Algebra, Engineering Optimization
- Nondestructive Testing

Skill Sets

- Project Leader – Coordinated a team of engineers working on the EPRI project. Leading, training and working closely with interns. Mentoring junior engineers.
- Delivered presentations and software demos at conferences and during various nuclear power plant site visits.
- Independently handled modules besides contributing substantially to the success of the team.
- Written project proposals, monthly reports and technical reports for various projects.
- Develop simple and novel strategies for problem solving.

Computer Experience

- *Engineering Software* – MATLAB (including GUI development), FEMLAB, PSpice
- *Other* – High Performance Computing Center (HPCC), Perforce
- *Languages* – C, C++, VC++, VB, Fortran, Incorporation of Matlab algorithms in C using MCR

Journal Publications

1. **S. Ramakrishnan**, Satish Udpa and Lalita Udpa, "Performance of Source Localization algorithms in detection of intrathoracic acoustic sources using noninvasive auscultation measurements on the human chest," *in preparation* (2009)
2. **S. Ramakrishnan**, Satish Udpa and Lalita Udpa, "A viscoelastic finite-difference time-domain model of human thorax simulating sound propagation of intrathoracic acoustic sources," *submitted to Journal of the Acoustical Society of America*, 2009.
3. **S. Ramakrishnan** and S. Udpa, "Comments on 'Detection of Distributed Sources Using Sensor Arrays'," *IEEE Transactions on Signal Processing*, Vol. 55, Issue 6, Part 1, pp. 2757-2758, June 2007.

4. Y. Tian, S. S. Udpa, N. Nair and **S. Ramakrishnan**, "Modeling of Electromagnetic Heating Effects During *in vivo* Testing of Prosthetic Heart Valves," *IEEE Transactions on Magnetics*, Vol. 42, Issue 10, pp. 3563-3565, October 2006.
5. S. C. Chan, R. Clifford, S. Majumdar, N. Nair, **S. Ramakrishnan**, Y. Li, P. Ramuhalli, L. Udpa and S. S. Udpa, "Novel methods for detecting fractures in prosthetic heart valves," *Insight: Nondestructive Testing and Condition Monitoring*, Vol. 47, No. 1, pp. 15-19, January 2005.
6. P. Xiang, **S. Ramakrishnan**, P. Ramuhalli, S.S. Udpa, L. Udpa, "Automated Analysis of Rotating Probe Multifrequency Eddy Current Data from Steam Generator Tubes," *Intl. Journal of Electromagnetics and Mechanics*, Vol. 12, No. 3-4, pp. 151-164, 2001.

Conference Proceedings

1. **S. Ramakrishnan**, S. Udpa and L. Udpa, "A Numerical Model to study Auscultation Sounds under Pneumothorax conditions," *accepted to be published in Proceedings of the 31st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2009.
2. **S. Ramakrishnan**, S. Udpa and L. Udpa, "A numerical model simulating sound propagation in human thorax," *accepted to be published in Proceedings of IEEE International Symposium on Biomedical Imaging (ISBI)*, 2009.
3. Z. Zeng, N. Lei, S. Majumdar, **S. Ramakrishnan**, C. E. Bardel, P. Lekeakatakunju, P. Ramuhalli, L. Udpa and T. Bipes, "Simulation of eddy current steam generator tube testing in nuclear power plants," *accepted to be published in Proceedings of Electromagnetic Nondestructive Evaluation (ENDE)*, 2009.
4. J. Benson, O. Udebhoo, R. K. Dayana, **S. Ramakrishnan**, S. Majumdar, P. Ramuhalli, L. Udpa and S. Udpa, "Automated Analysis Systems for Characterizing Eddy Current SG Inspection Data," *Proc. of Intl. Society of Electromagnetics and Mechanics (ISEM 2007)*, pp. 157-158, Sept. 2007.
5. S. Majumdar, **S. Ramakrishnan**, N. Nair, S. C. Chan, R. Clifford and S. S. Udpa, "A Modified FFT Algorithm for Efficient Computation of Narrow Band Spectrum," *IEEE International Conference on Electro Information Technology (EIT 2006)*, East Lansing, MI May 2006.
6. N. V. Nair, V. R. Melapudi, **S. Ramakrishnan**, L. Udpa, S. S. Udpa and W. P. Winfree, "A Wavelet Based Signal Processing Technique for Image Enhancement in Terahertz Imaging Data," *Review of Quantitative Nondestructive Evaluation*, D. O. Thompson and D. E. Chimenti, Eds., American Institute of Physics, 2005.
7. **S. Ramakrishnan**, N. V. Nair, R. Clifford, S. Majumdar, S. C. Chan, Y. Li, P. Ramuhalli, L. Udpa and S. S. Udpa, "An Electromagnetic Acoustic Transduction Technique for Detecting Strut Fractures in Artificial Heart Valves," *IEEE International Conference on Electro Information Technology (EIT 2005)*, Lincoln, NE, May 22-25, 2005.
8. N. V. Nair, **S. Ramakrishnan**, R. Clifford, Y. Li, S. Majumdar, S. C. Chan, P. Ramuhalli, L. Udpa and S. S. Udpa, "A Beat Frequency Electromagnetic Acoustic Transduction Technique for Detecting Strut Fractures in Prosthetic Heart Valves," *Proceedings of Electromagnetic Nondestructive Evaluation (ENDE 2004)*, Studies in App. Elect. And Mech., IOS Press, Vol. 25, 2005.
9. S. C. Chan, M. Oka, R. Clifford, S. Majumdar, N. Nair, **S. Ramakrishnan**, Y, Li, P. Ramuhalli, L. Udpa, and S. S. Udpa, "In Vitro Testing of a System for the Evaluation of Prosthetic Heart Valves," *Proceedings of Electromagnetic Nondestructive Evaluation (ENDE 2004)*, Studies in App. Elect. And Mech., IOS Press, Vol. 25, 2005.

10. N. V. Nair, **S. Ramakrishnan**, S. T. Thomas, R. Ahn, L. Udpa and S. S. Udpa, "Signal Processing Techniques for Detecting Strut Fractures in Prosthetic Heart valves," *International Conference on Eddy Current Non Destructive Evaluation (ENDE 2003)*, Paris, France, May 2003.
11. **S. Ramakrishnan**, S. T. Thomas, N. V. Nair, S. S. Udpa and K. Balasubramaniam, "An Electromagnetic Acoustic Technique for Non-Invasive Defect Detection in Mechanical Prosthetic Heart valves," *National Sem. of Indian Society for Non Destructive Testing (NDE 2002)*, Dec. 2002.

Presentations

1. **S. Ramakrishnan**, S. Udpa and L. Udpa, "An acoustic FDTD model of human thorax to develop multi-sensor techniques for noninvasive detection of thoracic pathologies," *First International Symposium on Audible Acoustics in Medicine and Physiology*, Sept 8-9 2008.
2. **S. Ramakrishnan**, S. Majumdar, P. Ramuhalli, L. Udpa, and S. Udpa, "Eddy Current AutoAnalysis Software Demo," *EPRI Tech. Advisory Group Mtg.*, Hyatt Regency Austin, TX, June 9, 2008.
3. Y. Tian, S. S. Udpa, N. Nair and **S. Ramakrishnan**, "Modeling of Electromagnetic Heating Effects During *in vivo* Testing of Prosthetic Heart Valves," *IEEE International Magnetics Conference*, San Diego, CA, May 8-12, 2006.
4. N.V. Nair, **S. Ramakrishnan**, R. Clifford, Y. Li, S. Majumdar, S. C. Chan, P. Ramuhalli, L. Udpa and S. S. Udpa, "A Beat Frequency Electromagnetic Acoustic Transduction Technique for Detecting Strut Fractures in Prosthetic Heart Valves," *International Workshop on Electromagnetic Nondestructive Evaluation*, East Lansing, MI, June 1-2, 2004.
5. **S. Ramakrishnan**, S. Mukherjee, S. Soo, J. Chen, P. Ramuhalli, L. Udpa, and S. Udpa, "Eddy Current AutoAnalysis Software Demo," Palo Verde Nuclear Power Plant, Phoenix, AZ, 2003.
6. **S. Ramakrishnan**, P. Ramuhalli, L. Udpa, and S. Udpa, "Eddy Current AutoAnalysis Matlab GUI Demonstration," San Onofre Nuclear Generating Station, San Diego, CA, 2002.

Awards and Activities

- IEEE Student Member (2002-Present)
- Student of Taekwondo (2006-Present)
- Volunteer for
  - *Child Rights and You (CRY)* – a non profit organization that works towards restoring basic rights to underprivileged children in India and US (2008-Present)
  - *International Volunteer Action Corps (IVAC)* – a volunteer organization that brings domestic and international students together for relationship building through various activities (2008-Present)
  - *Sankalp* – an NGO that works towards improving the socio-economic conditions of poorer sections of the society in India (2000-2002)
- Elected as Cultural Secretary of MSU India Club (2004-2005)
- Ranked 8th by Indian Teacher's Mathematics Association (1995)
- Received "Indian National Talent Search Scholarship" Award (1994)
- Winner of College Lawn Tennis Tournament (1999)

References

Available upon request.