

K. Aditya Mohan

CONTACT INFORMATION 146 Arnold Dr., Apt. 2,
West Lafayette, IN, 47906

Phone: +1 (765) 421-5295
E-mail: mohank@purdue.edu

RESEARCH INTERESTS Inverse Problems, Computational Imaging, Optimization Algorithms, Signal & Image Processing, X-ray & Electron Tomography, Machine Learning, High Performance Parallel Computing.

EDUCATION **Ph.D. candidate**, Electrical and Computer Engineering Aug. 2011 - Present
Purdue University, West Lafayette, IN USA GPA : 4.0/4.0
Advisor: Charles A. Bouman
Research Focus: Data sampling and reconstruction algorithms for X-ray computed tomography, phase contrast tomography, and vector field electron tomography.

M.S., Electrical and Computer Engineering Aug. 2011 - May 2014
Purdue University, West Lafayette, IN USA GPA : 4.0/4.0

B.Tech., Electronics and Communication Engineering Aug. 2006 - May 2010
National Institute of Technology Karnataka, Surathkal, India GPA : 9.01/10

AWARDS & HONORS

- Invited speaker at the ALS User Meeting 2016, Lawrence Berkeley National Lab, USA. Oct. 2016
- Student best paper award at the IEEE International Conference on Image Processing (ICIP) 2016, the worlds largest conference focused on image processing and computer vision. Sept. 2016
- One among seven finalists for the Werner Meyer-Ilse Memorial award at the X-ray Microscopy Conference (XRM) 2016. Aug. 2016
- Invited speaker at the Microscopy and Microanalysis Conference (M&M) 2016, Columbus, Ohio, USA. July 2016
- Winner of the Surathkal Innovation Challenge 2010, an entrepreneurial challenge that included a seed grant of INR 100,000 for funding a start-up. Jan 2010

RESEARCH EXPERIENCE **Purdue University**, West Lafayette, IN, USA May 2012 - Present
Graduate Research Assistant, Advisor - Prof. Charles A. Bouman

Time interlaced model-based iterative reconstruction (TIMBIR) for 4D X-ray synchrotron tomography.

- 2-BM and 32-ID beamlines at APS support the interlaced view sampling method of TIMBIR.
- Reconstruction code is installed and available for users at ALS, Lawrence Berkeley National Lab.
- Achieved upto $32\times$ gain in temporal resolution without any new investment in detector technology.
- Code is optimized to run in parallel on super-computing clusters (<https://github.com/adityamnk/timbir>).

Reconstruction of Al-Cu dendritic solidification in real time using TIMBIR.

- Observed new physics of dendritic solidification that was published in Nature Scientific Reports.
- Recognized by APS management as one of the outstanding recent results from their beamlines.
- Appears among the science highlights in the 2015 APS annual report of Argonne national lab.

Complex refractive index tomographic iterative reconstruction (CRITIR) algorithm for X-ray phase contrast tomography.

- Jointly reconstruct the absorption and refractive index distribution of a 3D object.
- CRITIR does not make any approximations beyond the assumption of Fresnel diffraction.
- Designed to work within and beyond the near-field diffraction region.

Algorithm to reconstruct the magnetization of an object using vector field electron tomography (VFET).

- First algorithm to reconstruct the 3D distribution of magnetization using VFET.
- Does not make the divergence-less assumption for the magnetic vector potential.

Argonne National Lab, Lemont, IL, USA Jun. 2015 - Aug. 2015

Research Aide, Supervisors - Dr. Xianghui Xiao and Dr. Francesco De Carlo

- Worked as a summer research aide in the X-ray science division (XSD) at the advanced photon source (APS).
- Formulated and implemented an algorithm to reconstruct both the absorption and refractive index distribution of an object from propagation based X-ray phase contrast tomography data.

Indian Institute Of Science, Bangalore, India May 2009 - Jul. 2009

Summer Research Intern, Advisor - Prof. Chandra R. Murthy

- Worked as a summer research intern in the department of electrical and communication engineering.
- Designed and implemented an algorithm for binary hypothesis testing based on sequential detection using cyclostationary features of signals.

TEACHING
EXPERIENCE

Temporary Lectures, Digital Image Processing I, Purdue University Spring 2015

- Conducted lectures on 2D finite impulse response (FIR) filters.

Teaching Assistant, Signals and Systems, Purdue University Fall 2011

- Conducted recitation classes to help students prepare for exam by solving example problems.
- Held regular office hours to help students understand the lectures and solve homework problems.
- Graded mid-term and final exams.

Teaching Assistant, Probabilistic Methods for ECE, Purdue University Spring 2012

- Held regular office hours to help students understand the lectures and prepare for exams.
- Helped the instructor prepare exam questions.

PROFESSIONAL
EXPERIENCE **ASIC Design Engineer, Nvidia**, Bangalore, India Aug. 2010 - Jun. 2011

- Performed full chip source code and gate level verification of the Kepler series of graphics processing units (GPU).
- Ran a large number of tests on the full chip source code and debugged all failures.
- Also setup a test bench for gate level verification, ran gate level tests, and debugged all failures.

Internship, Manipal Dot Net Pvt. Ltd., Manipal, India May 2008 - Jul. 2008, Fall 2008

- Implemented an Altera FPGA based hardware accelerator for fisheye correction and stitching of images from multiple fisheye cameras. Project was demonstrated at the **North American Auto Show, Detroit** and **Embedded Systems Conference Silicon Valley 2009, San Jose**.
- Implemented a hardware accelerator called Bit Blitter on an Altera FPGA to speed up graphics performance. In the words of **Altia's CEO** - "The performance gains by using this core is up to 50% in some cases. Even using other more advanced IP solutions, we've only seen the performance increase by at most 20% over what the BitBlitter core has provided."

GRADUATE COURSES	Digital Signal Processing I Random Variables Digital Image Processing I Digital Image Processing II Computational Models and Methods Information Theory and Source Coding Stochastic Processes Performance Modeling of Comm Networks	Computer Communication Networks Optimization Methods for Systems and Controls Linear Algebra Applications Introduction to Mathematical Statistics Digital Video Systems Introduction to Compressed Sensing Real Analysis
SEMINARS	<p>“Model-Based Iterative Reconstruction Algorithms for Absorption and Phase Contrast Tomography,” Integrated Imaging Initiative (I3) Seminar, Argonne National Lab, Lemont, IL, 7th March 2016.</p> <p>“Model-Based Iterative Reconstruction Algorithms for Absorption and Phase Contrast Tomography,” Lawrence Livermore National Lab, Livermore, CA, 3rd March 2016.</p> <p>“Model-Based Iterative Reconstruction Algorithms for Absorption and Phase Contrast Tomography,” Lawrence Berkeley National Lab, Berkeley, CA, 2nd March 2016.</p>	
JOURNAL PUBLICATIONS	<p>J. W. Gibbs, K. A. Mohan, E. B. Gulsoy, A. J. Shahani, X. Xiao, C. A. Bouman, M. De Graef, P. W. Voorhees, “The Three-Dimensional Morphology of Growing Dendrites,” Nature Scientific Reports, vol.5, 2015</p> <p>K. A. Mohan, S. V. Venkatakrisnan, J. W. Gibbs, E. B. Gulsoy, X. Xiao, M. De Graef, P. W. Voorhees, C. A. Bouman, “TIMBIR: A Method for Time-Space Reconstruction from Interlaced Views,” IEEE Transactions on Computational Imaging, vol.1, no.2, pp.96-111, June 2015</p>	
CONFERENCE PUBLICATIONS	<p>K. A. Mohan, X. Xiao, C. A. Bouman, “Direct Model-Based Tomographic Reconstruction of the Complex Refractive Index,” <i>accepted at the IEEE International Conference on Image Processing (ICIP)</i>, September 2016. (Student best paper award)</p> <p>S. V. Venkatakrisnan, K. A. Mohan, K. Beattie, J. Correa, E. Dart, J. R. Deslippe, A. Hexemer, H. Krishnan, A. A. MacDowell, S. Marchesini, S. J. Patton, T. Perciano, J. A. Sethian, R. Stromsness, B. L. Tierney, C. E. Tull, D. Ushizima, and D. Y. Parkinson, “Making Advanced Scientific Algorithms and Big Scientific Data Management More Accessible”, to appear in SPIE Electronic Imaging 2016, Computational Imaging XIV.</p> <p>X. Wang, K. A. Mohan, S. Kisner, C. Bouman, and S. Mikdiff, “Fast Voxel Line Update for Time-Space Image Reconstruction,” IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2016, pp. 1209-1213.</p> <p>K. A. Mohan, S. V. Venkatakrisnan, J. W. Gibbs, E. B. Gulsoy, X. Xiao, M. De Graef, P. W. Voorhees, C. A. Bouman, “4D model-based iterative reconstruction from interlaced views,” IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp.783-787, April 2015</p> <p>K. A. Mohan, S. V. Venkatakrisnan, L. F. Drummy, J. Simmons, D. Y. Parkinson, C. A. Bouman, “Model-based iterative reconstruction for synchrotron X-ray tomography,” IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp.6909-6913, May 2014</p> <p>K. A. Mohan, C. R. Murthy, “Cooperative sequential binary hypothesis testing using cyclostationary features,” IEEE Eleventh International Workshop on Signal Processing Advances in Wireless Communications (SPAWC), pp.1-5, June 2010</p> <p>K. A. Mohan, A. K. Senapathi, R. Shankar, N. Bhat and V. Kumar, “Hardware acceleration of real</p>	

time fish eye correction on FPGA,” National Conference on Information Sciences, Manipal, March 2009.

K. A. Mohan, A. K. Senapathi, R. Shankar, N. Bhat and V. Kumar, “Hardware acceleration of real time stitching of streaming videos from multiple fisheye cameras,” National Conference on Information Sciences, Manipal, March 2009.

CONFERENCE ABSTRACTS **K. A. Mohan**, S. V. Venkatakrishnan, J. W. Gibbs, E. B. Gulsoy, X. Xiao, M. De Graef, P. W. Voorhees, C. A. Bouman, “TIMBIR: A Method For High Temporal Resolution Tomographic Reconstruction,” *accepted at the* International Conference on X-ray Microscopy (XRM), Aug. 2016.

K. A. Mohan, X. Xiao, C. A. Bouman, “CRITIR: Direct Tomographic 3D Reconstruction of the Complex Refractive Index,” *accepted at the* International Conference on X-ray Microscopy (XRM), Aug. 2016.

K. A. Mohan, Prabhat K. C., C. Phatak, M. De Graef, C. A. Bouman, “Iterative Reconstruction of the Magnetization and Charge Density using Vector Field Electron Tomography,” *accepted at the* Microscopy & Microanalysis (M&M) Meeting, July 2016.

Prabhat KC, M. D. Graef, C. Bouman, and **K. A. Mohan**, “Extracting the Magnetic Vector Potential of Magnetic Nanoparticles Using a Model Based Iterative Reconstruction Technique,” 3rd International Congress on 3D Materials Science (3DMS), July 2016.

X. Xiao, **K. A. Mohan**, C. A. Bouman, “Complex refractive index tomographic iterative reconstruction - A new phase retrieval algorithm for phase-contrast tomography”, Developments in X-Ray Tomography X, part of SPIE Optical Engineering and Applications.

FEATURED ARTICLES “Now Showing in 3-D: The Growth of Metallic Dendrites,” APS Science Highlights - 2015, Argonne National Lab, Oct 2015, <https://www1.aps.anl.gov/APS-Science-Highlight/2015/Now-Showing-in-3-D-The-Growth-of-Metallic-Dendrites>.

“A Flexible Architecture for Fisheye Correction in Automotive Rear-View Cameras,” Altera, 2010, https://www.altera.com/en_US/pdfs/literature/wp/wp-01073-flexible-architecture-fisheye-correction-automotive-rear-view-cameras.pdf.

PROFESSIONAL ACTIVITIES

- IEEE student member Jan. 2007 - Present
- Eta Kappa Nu (HKN) member Jan. 2015 - Present
- Served HKN events committee Sep. 2015 - Dec. 2015

COMPUTER SKILLS

- Languages: C, C++, Python, Matlab, VHDL, Verilog
- Parallel Programming: OpenMP, MPI
- Operating Systems: Unix/Linux, OS X, Windows

LEADERSHIP & EXTRA-CURRICULAR ACTIVITIES

- Community service volunteer activities on behalf of HKN - Light the night leukemia walk, Boo in the zoo, etc.
- Volunteer activities for the non-profit organization called Asha that funds education for underprivileged children.
- Organized events and concerts for promoting Indian classical music on behalf of SPIC-MACAY during my undergraduate studies.
- Elected by all the students at my school to be the associate school people leader in my tenth grade.

REFERENCES

Prof. Charles A. Bouman (Thesis Advisor)
School of Electrical and Computer Engineering
Purdue University
West Lafayette, IN 47907
Email: bouman@purdue.edu
Phone: +1 (765) 494-0340

Prof. Peter Voorhees
Material Science and Engineering
Northwestern University
Evanston, IL, 60208
Email: p-voorhees@northwestern.edu

Prof. Mary Comer
School of Electrical and Computer Engineering
Purdue University
West Lafayette, IN 47907
Email: comerm@purdue.edu
Phone: +1 (765) 494-3486

Prof. Marc De Graef
Department of Material Science
Carnegie Mellon University
Pittsburgh, PA 15213
Email: degrae@cmu.edu
Phone: +1 (412) 268-8527