

Curriculum Vita

Philip R. Bingham

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Experience

Dr. Bingham is the acting group leader for the Imaging, Signals & Machine Learning Group at the Oak Ridge National Laboratory. In the twelve years he has been working at ORNL, he has been involved with many aspects of image processing for applications in industrial inspection and national security. In 2009, he received an early career award from the US Department of Energy for a 5 year program to develop high resolution neutron radiography capabilities using coded source imaging. Prior to this effort, he participated in and led a multi-lab initiative on air cargo inspection which investigated the application of a wide range of inspection techniques to the challenge of locating threats in air cargo. At ORNL, Philip has gained experience in development of systems and algorithms for radiography and computed tomography with both x-ray and neutron sources and development of holographic imaging systems and algorithms with applications in semiconductor wafer defect detection, mask inspection, ballistic matching, and cellular imaging. Previous to joining ORNL, he attended Georgia Tech and worked as a research assistant in the Computer Engineering Research Laboratory (CERL). In that role, he was involved in both the software and hardware development of custom computing systems ranging from parallel computing systems to custom ASICs. Philip's research interest is in the combination of image/signal processing techniques with unique sensor systems to develop new measurement capabilities.

Education

- Ph.D.** Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, 1999.
Dissertation: The Effect of Message Length Distribution on the Performance of Fully Connected Switches.
- M.S.** Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, Georgia, 1991.
- B.S.** Electrical and Computer Engineering, University of Tennessee, Knoxville, Tennessee, 1989.

Publications

- H.J. Santos-Villalobos and P.R. Bingham, "Non-Uniform Contrast and Noise Correction for Coded Source Neutron Imaging," SPIE Electronic Imaging 2012: Computational Imaging IX, Jan 22, 2012.
- P.R. Bingham, S.D. Miller, T.L. Nichols, S.S. Gleason, and M.L. Green, "Large-scale User Facility Imaging and Scattering Techniques to Facilitate Basic Medical Research," Chapter in "Medical Imaging," ISBN 978-953-307-774-1.
- P.R. Bingham, and H.J. Santos-Villalobos, "Coded source neutron imaging," SPIE Electronic Imaging Symposium – Machine Vision and Industrial Applications IV, San Francisco, USA, Jan 25, 2011.
- Z. Xiao, K. Mishra, A. Hawari, P.R. Bingham, H.Z. Bilheux, K.W. Tobin, "Coded source neutron imaging at the PULSTAR reactor," Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Vol 652, No. 1, pp. 606, 2011.
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- J. Gregor, M.W. Lenox, P.R. Bingham, and L.F. Arrowood, "Multi-Core Cluster Implementation of SIRT with Application to Cone Beam Micro-CT," 2009 IEEE Nuclear Science Symposium, Orlando, FL, Jan. 29, 2010.
- M.A. Blackston, P.A. Hausladen, P.R. Bingham, M.N. Erickson, and L. Fabris, "Using Fast Neutrons to Image Induced Fissions," 2009 IEEE Nuclear Science Symposium, Orlando, FL, Jan. 29, 2010.
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- P.R. Bingham and L.F. Arrowood, "Projection Registration Applied to Non-destructive Testing," Quality Control for Artificial Vision Conference, Wels, Austria, May27-29, 2009.
- C.J. Mann, P.R. Bingham, K.W. Tobin, and V.C. Paquit, "Quantitative phase imaging by three-wavelength digital holography," Optics Express, Vol. 16, No. 13, pp. 9753, 2008.
- P.R. Bingham and L.F. Arrowood, "Application of registration to 3-dimensional non-destructive testing." ASNT Digital Imaging XI conference, Mashantucket, CT, July 2008.
- L.F. Arrowood and P.R. Bingham, "Advanced Registration of CT projection Data for Industrial Applications," ASNT Digital Imaging XI conference, Mashantucket, CT, July 2008.
- J.A. Mullens, P.A. Hausladen, P.R. Bingham, D.E. Archer, and J.T. Mihalczko, "Use of Imaging for Nuclear Material Control and Accountability," ESARDA Bulletin, No. 38, June 2008.
- B. Riemer, P.R. Bingham, F.G. Mariam, and F.E. Merrill, "Measurement of Gass Bubbles in Mercury Using Proton Radiography," 8th international topical meeting on nuclear applications and utilization of accelerators, AccApp07, Pocatello, ID, Aug. 2007.

- P.A. Hausladen, P.R. Bingham, J.S. Neal, J.A. Mullens, and J.T. Mihalczco, "Portable fast-neutron radiography with the nuclear materials identification system for fissile material transfers," Nuclear Instruments and methods in Physics Research, Sec B, Vol. 261, pp. 387-90, Aug. 2007.
- P. Bingham, L. Arrowood, and J. Gregor, "Calibration and Performance Testing for Reconfigurable Computed Tomography Systems," Materials Evaluation, Vol. 65, No. 11, pp. 1102-1107, Nov. 2007.
- L. Arrowood, J. Gregor, and P. Bingham, "Iterative Reconstruction Techniques for Industrial Computed Tomography: Application and Performance," Materials Evaluation, Vol. 65, No. 11, pp. 1109-1112, Nov. 2007.
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- P.A. Hausladen, P.R. Bingham, and J.A. Mullens, "Analytically Computed Small-Angle Scattering in Fast-Neutron Radiography," 2006 Nuclear Science Symposium and Medical Imaging Conference, San Diego, CA, October 31, 2006.
- P. Hausladen, P. Bingham, J. Neal, J. Mullens, and J. Mihalczco, "Portable Fast-Neutron Radiography with the Nuclear Materials Identification System," Proceedings of the 19th International Conference on the Application of Accelerators in Research and Industry, August, 2006.
- J.T. Mihalczco, J.A. Mullens, P.A. Hausladen, P.R. Bingham, J. Neal, M. Wright, and D. Archer, "Enhanced NMC&A by Imaging," Proceedings of the institute of Nuclear Materials Managers 47th Annual Meeting, July 2006.
- P. Hausladen, P. Bingham, T. Karnowski, J. Mullens, and J. Mihalczco, "Development of a Tomographic Imaging System for HEU Components," Presentation at the Fall 2005 INMM Central Region Chapter Meeting Conference titled Challenges to Safeguards and Security, October 12, 2005.
- K.W. Tobin and P.R. Bingham, "Optical Spatial Heterodyned Interferometry for Applications in Semiconductor Inspection and Metrology," International Conference on Lasers, Applications, and Technologies, St. Petersburg, Russia, Proceedings of SPIE, Vol. 6162, May 2005.
- P.R. Bingham, K.W. Tobin, G.R. Hanson, and J.T. Simpson, "Spatial heterodyne interferometry techniques and applications in semiconductor wafer manufacturing", Interferometry XII: Techniques and Analysis, August 2004.
- J.A. Mullens, J.T. Mihalczco, and P.R. Bingham, "Neutron and Gamma Ray Imaging for Nuclear Materials Identification," Proceedings of the institute of Nuclear Materials Managers 45th Annual Meeting, July 2004.
- P.R. Bingham, J.R. Price, K.W. Tobin, and T.P. Karnowski, "Semiconductor sidewall shape estimation," Journal of Electronic Imaging, Vol. 13, No. 3, pp. 474-485, July 2004.
- P.R. Bingham, K.W. Tobin, M.H. Bennett, and P. Marmillion, "Phase defect detection with spatial heterodyne interferometry," Metrology, Inspection, and Process Control for Microlithography XVIII, SPIE, Vol. 5375, pp. 18-28, February 2004.
- P.R. Bingham, K.W. Tobin, M.H. Bennett, and P. Marmillion, "Preliminary results for mask metrology using spatial heterodyne interferometry," 23rd annual BACUS Symposium on Photomask Technology, SPIE, Vol. 5256, pp. 1331-42, 2003.
- J.R. Price, P.R. Bingham, K.W. Tobin, and T.P. Karnowski, "Semiconductor Sidewall Estimation Using Top-Down Image Retrieval," Sixth International Conference on Quality Control by Artificial Vision, SPIE, Vol. 5132, p. 209-219, May 2003.
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- P.R. Bingham, J.R. Price, K.W. Tobin, T.P. Karnowski, M.H. Bennett, H. Bogardus, and M. Bishop, "Sidewall Structure Estimation from CD-SEM for Lithographic Process Control," Process and Materials Characterization and Diagnostics in IC Manufacturing II, SPIE, February 2003.
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- P.R. Bingham, C.O. Alford, R.W. Melton, and T.C. Huang, "Parallel Application Optimization via Network Models," Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications, Vol. IV, pp. 2252-2258, July 1999.
- T.C. Huang, R.W. Melton, C.O. Alford, and P.R. Bingham, "TCP/UDP/IP Protocol Processing with a RISC Instruction Set," Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications, pp. 645-652, July 1998.
- P.R. Bingham, C.O. Alford, R.W. Melton, and T.C. Huang, "Bandwidth of Fully Connected Switches Transferring Continuous Messages," Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications, pp. 1859-1862, July 1998.
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- Hanson, G.R., Bingham, P.R., Tobin, K.W., "Spatial-heterodyne interferometry for reflection and transmission (SHIRT) measurements", U.S. Patent 6,999,178 issued February 14, 2006.
- Price, J.R., and Bingham, P.R., "Fused off-axis object illumination direct-to-digital holography with a plurality of illumination sources," U.S. Patent 6,963,406, November 8, 2005.
- Hanson, G.R., Bingham, P.R., Simpson, R.T., Voelkle, E., and Karnowski, T.P., "Technique for Obtaining Two-Wavelength Differential-Phase Direct-to-Digital Heterodyned Holograms", ORNL ID No. 0933, April, 2003, (Patent pending).
- Hanson, G.R., and Bingham, P.R., "Recording Multiple Spatially-Heterodyned Direct to Digital Holograms in One Digital Image", U.S. Patent 7,349,100, March 25, 2008.
- Hanson, G.R. and Bingham, P.R., "Faster Processing of Multiple Spatially-Heterodyned Direct to Digital Holograms", ORNL ID No. 0933.2, U.S. Patent 7,116,425, Oct. 3, 2006, U.S. Patent 7,423,763 Sept. 9, 2008.
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- Tobin, K.W., Bingham, P.R., Hawari, A.I., "Apparatus and method to achieve high-resolution microscopy with non-diffracting or refracting radiation," filed Oct. 2, 2009, US Patent Appl No. 20110079725.
- Mann, C.J., Bingham, P.R., "Quantitative phase-contrast and excitation-emission systems," filed Mar. 9, 2009, US Patent Appl. No. 20100231896.
- Mann, C.J., Bingham, P.R., Gleason, S.S., "Quantitative phase imaging systems," Filed Mar. 16, 2009, US Patent Appl. No. 20100231895.

Awards

- Oak Ridge National Laboratory Awards Night Finalist for Inventor of the Year Award for work in extending the Direct to Digital Holography portfolio, November 2003.
- National Federal Laboratory Consortium Award for Excellence in Technology Transfer, "Direct-to-Digital Holography for High-Speed, High Resolution Defect Inspection", March 2002.
- Oak Ridge National Laboratory Awards Night Recognition for Engineering Development by a Team for developing a first of a kind direct to digital holographic prototype wafer defect detection system, November 2001.
- Oak Ridge National Laboratory Significant Event Award for development and implementation of image processing and control algorithms and software for the prototype direct to digital holographic wafer defect detection system, 2001.

Technical Reports

- Bingham, P.R., White, T., Cespedes, E., Bowerman, B., Bush, J, "National Security Science and Technology Initiative: Air Cargo Screening," ORNL Report Pub.ID 27159, November, 2010.
- Bingham, P.R., Karnowski, T.P., Tobin, K. W., Bennett, M.H., Marmillion, P., "Advanced Methods for Optical Holography," Technology Transfer 25219, International SEMATECH, Austin, TX, December 2005.
- Tobin, K. W., Bingham, P.R., Bennett, M.H., Marmillion, P., "Optical Holographic Mask Metrology in Transmission and Reflection," Technology Transfer 04084553A-ENG, International SEMATECH, Austin, TX, August 2004.
- Tobin, K. W., Bingham, P.R., Bourgeat, P., Chidley, Dixon, R., M., Bennett, Bogardus, H., "Digital Holographic Metrology for Lithography Mask Characterization," Technology Transfer 02124357A-ENG, International SEMATECH, Austin, TX, December 2004.
- Tobin, K. W., Bingham, P.R., Price, J.R., Bennett, M.H., Bishop, M., and Bogardus, H., "CD SEM Sidewall Structure Estimation Using Automated Image Retrieval," Technology Transfer 03014369A-TR, International SEMATECH, Austin, TX, February 2003.
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