Lawrence K. Chilton

Curriculum Vitae

Business Address:
Pacific Northwest National Laboratory
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1930 Newhaven Loop
Richland, WA 99352
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Professional Experience:

2011-present Adjunct Faculty – Mathematics, Washington State University, Tri-Cities
Taught Math 171 – Calculus, Fall 2011. Teaching Math 140 – Calculus for Life Sciences, Spring 2012.

2005-present Senior Research Scientist, Pacific Northwest National Laboratory (PNNL), Richland, WA
Simulations, Algorithms, and Modeling program manager - $1.25M in funded research in 2012. Research projects include Bayesian methods for hyperspectral remote sensing, inverse problems on sensor networks, gamma-ray spectral analysis for isotope identification, maritime cargo modeling, and video information content analysis. For three years, led the Statistics and Sensor Analytics group (38 researchers) providing "data to decision" sensor system analysis. The group applies statistical and mathematical analysis to critical national security programs.

2002-2005 Associate Professor of Mathematics and Deputy Department Head, Air Force Institute of Technology (AFIT), Wright-Patterson AFB, OH

2002 Adjunct Faculty, University of Dayton, Dayton, OH
Taught Business Statistics

2001 Adjunct Faculty, Wright State University, Dayton, OH
Taught Trigonometry

1997-2005 Associate Professor of Mathematics and Deputy Department Head, Air Force Institute of Technology (AFIT), Wright-Patterson AFB, OH
Developed and taught courses in numerical and applied mathematics. Directed research program in computational methods for solving partial differential equations, including finite element methods. Directed Air Force sponsored student research in several areas including signal/image processing, aircraft safety and performance, and stochastic differential equations. As Deputy Department Head recruited and hired military and civilian faculty. Doubled the success rate of military faculty completing degree requirements on time. Served as chair of the Information Resources Committee (IRC) for the graduate school. Served on several faculty committees including Academic Standards Committee (Chairman)

and Curriculum and Degree Requirements Committee. Hand selected to help find the next Dean of Faculty for the Graduate School. Organized department research seminars.

1994-1997 Ph.D. Student, University of Maryland Baltimore County, MD

1992-1994 Electronic Imaging Lab Chief, NSA, Ft Meade, MD
Directed development of imaging, image processing, and image analysis methods as well as production imaging supporting DoD activities. Invented automatic electronic inspection system. Awarded NSA Scientific Achievement award. Overhauled process to publish NSA research for national cryptographic community. Regularly briefed flag level military and civilian leaders for Air Staff, FBI, CIA, NSA, and Congress on InfoSec capabilities.

1991 Adjunct Faculty, Chapman College, Colorado Springs, CO
Taught Business Math and C Programming

1988-1992 Assistant Professor of Mathematics, USAFA, Colorado Springs, CO
Developed and taught courses in Statistics, Mathematical Analysis, and Engineering Math. Directed math major programs at USAFA, supervising 15 officers and 96 cadets. Putnam exam coach. Directed cadet summer research program. Scientific lead on war-game development team. Presented multiple faculty seminars.

1987-1988 M.S. Student, University of Illinois, Urbana-Champaign, IL

1983-1987 Avionics Systems Engineer, Foreign Technology Division, Wright-Patterson AFB, OH
Analyzed foreign tactical missile guidance and control systems. Specialized in Anti-Radiation missiles. Developed simulations to assess missile performance against various target environments. Assessments published in several DoD publications and used to support DoD and Air Force countermeasure programs.

Education:

Ph.D. Applied Mathematics — August 1997
University of Maryland, Baltimore County

M.S. Applied Mathematics — May 1988
University of Illinois, Urbana-Champaign

Bachelor of Electrical Engineering — March 1983
Auburn University

B.A. Applied Mathematics — June 1981
University of California, San Diego

Courses Taught:

US Air Force Academy (1988-1992)

Math 220	Statistical Methods
Math 243	Calculus III
Math 245	Differential Equations and Matrices
Math 346	Engineering Math
Math 451	Complex Variables
Math 466	Real Analysis I
Math 467	Real Analysis II

Air Force Institute of Technology (1997-2005)

Stat 527	Introduction to Probability
Math 291	Calculus for Engineering Managers
Math 504	Differential Equations of Mathematical Physics
Math 508	Applied Numerical Methods
Math 511	Methods of Applied Mathematics I
Math 513	Methods of Applied Mathematics II
Math 521	Applied Linear Algebra
Math 600	Mathematical Analysis
Math 611	Introduction to Partial Differential Equations
Math 672	Numerical Linear Algebra
Math 674	Numerical Analysis I
Math 676	Numerical Analysis II (Finite Difference Methods)
Math 678	Numerical Analysis III (Finite Elements Analysis)

Academic Service:

Deputy Head, Department of Mathematics and Statistics, AFIT	2001-2003
Chair, Information Resources Committee, AFIT	2001-2005
Member, Information Resources Committee, AFIT	1999-2005
Member, Curriculum and Degree Requirement Committee, AFIT	1999-2001
Chair, Academic Standards Committee, AFIT	1998-1999
Member, Academic Standards Committee, AFIT	1997-2005
Advisor in Charge, Department of Mathematical Sciences, USAFA	1990-1992

Research Interests:

Applied Mathematics - numerical analysis, numerical solution of PDEs, finite element analysis, numerical linear algebra, uncertainty quantification, inverse problems on sensor networks

Video/Image and Signal Processing – information physics, video content analysis, level set methods, statistical signal processing, algorithm development

Random Differential Equations – finite element based Monte Carlo methods

Scientific Computation - computational methods in elasticity and electromagnetics, parallel algorithms, cluster computing

Funded Research:

L.Chilton and J. Friese, "Time-stamped Coincidence-sampled Gamma-ray Spectral Data Analysis", PNNL LDRD, $200K, 2012

L.Chilton and J. Friese, "Time-stamped Coincidence-sampled Gamma-ray Spectral Data Analysis", NSD LDRD, $50K, 2011

L. Carin and L. Chilton, "Compressive Sensing and Deep Learning for Analysis of Hyperspectral Imagery", NNSA/DOE, $1.125M, 2011-2013

S. Lu and L. Chilton "Real-time Model Validation and Calibration for Large Interconnected Time-variant Systems Using Online Measurement Data", DOE/ASCR, $1.2M, 2010-2012

S. Thompson and L. Chilton, "Decision Support Tools for Export Control Applications", NNSA/DOE, $1.05M, 2008-2010

L. Chilton and D. Anderson, "Bayesian Spatial-Temporal Algorithms for Analysis of Remotely Sensed Hyper-Spectral Signatures", NNSA/DOE, $1.2M, 2005-2007

L. Chilton, "Markov Chain Monte Carlo Methods for Image Analysis", Pacific Northwest National Labs, $15K, 2004

L. Chilton, "AFIT High Performance Computing Summer Research Program", HPCMO, $42K, 2004

L. Chilton, "AFIT High Performance Computing Summer Research Program", HPCMO, $38K, 2003

L. Chilton, "AFIT High Performance Computing Summer Research Program", HPCMO, $36K, 2002

L. Chilton, "Finite Element Methods for Finite Elasticity and Elastoplasticity", AFOSR, $16.3K, 2000-2002.

Peer Reviewed Publications:

K. D. Jarman, C. Sherrer, E. L. Smith, L. Chilton, K. K. Anderson, J. J. Ressler, and L.L. Trease, "*Indirect Estimation of Radioactivity in Containerized Cargo*", Radiation Measurements, **46**(1):10-20, 2011.

R. Roberts, T. Trucano, P. Pope, C. Aragon, M. Jiang, T. Wei, L. Chilton, and A. Bakel, "*On The Verification and Validation of Geospatial Image Analysis Algorithms*",

Proceedings of the 2010 IEEE International Geoscience and Remote Sensing Symposium, July 25, 2010, ISBN 978-1-4244-9566-5, 174-177.

K. K. Anderson, M. Tardiff, and L. Chilton, "*Predicting the Detectability of Thin Gaseous Plumes in Hyperspectral Images Using Basis Vectors*", Sensors, **10**, 8652-8662, 2010.

D. Cook, L. Holder, S. E. Thompson, P. D. Whitney, and L. Chilton, "*Graph-Based Analysis of Nuclear Smuggling Data*", Journal of Applied Security Research, **4**:501-517. 2009.

L. Chilton and S. Walsh, "*Detection of Gaseous Plumes using Basis Vectors*", Sensors, **10**, 3205-3217, 2009.

S. Walsh, L. Chilton, M. Tardiff, and C. Metoyer, "*Effect of the Temperature-Emissivity Contrast on the Chemical Signal for Gas Plume Detection Using Thermal Image Data*", Sensors, **8**, 6471-6483, 2008.

D. R. Millman, P. I. King, R. C. Maple, P. S. Beran, and L. K. Chilton, "*Estimating the probability of failure of a nonlinear aeroelastic system*", Journal of Aircraft, **43**:2, 504-516, 2006.

F. B. Belgacem, L. Chilton and P. Seshaiyer, "*Non-conforming computational methods for mixed-elasticity problems*", Computational Methods in Applied Mathematics, **3**:1, 23-34, 2003.

F. B. Belgacem, L. Chilton and P. Seshaiyer, "*The hp-mortar finite element method for the mixed elasticity and Stokes problems*", Computers and Mathematics with Applications, **46**:35-55, 2003.

L. Chilton and P. Seshaiyer, "*The hp mortar domain decomposition method for problems in fluid mechanics*", International Journal for Numerical Methods in Fluids, **40**:1561-1570, 2002.

F. B. Belgacem, L. Chilton and P. Seshaiyer, "*Non-conforming hp finite element methods for Stokes problem*", Invited Chapter in "Recent Developments in Domain Decomposition Methods", Lecture Notes in Computational Science and Engineering Series, Springer-Verlag, New York, **23**:133-146, August 2002 (ISBN 3-540-43413-5)

L. Chilton and M. Suri, "*Locking-free mixed hp finite element methods for curvilinear domain*s", Computer Methods in Applied Mechanics and Engineering, **190**:3427-3442, 2001.

L. Chilton and M. Suri, "*On the construction of stable curvilinear p-version elements for mixed formulations of elasticity and Stokes flow*", Numerische Mathematik, **86**:29-48, 2000.

L. Chilton and M. Suri, "*On the selection of a locking-free hp element for elasticity problems*", International Journal for Numerical Methods in Engineering, **40**:2045-2062, 1997.

Other Publications:
M. F. Tardiff, S. J. Walsh, K. K. Anderson, and L. Chilton, "*Predicting detection probabilities for gas mixtures over HSI backgrounds*", 2009, PNNL-19069, Pacific Northwest National Laboratory, Richland, WA.

C. N. Metoyer, S. J. Walsh, M. F. Tardiff, and L. Chilton, "*Statistics for the Relative Detectability of Chemicals in Weak Gaseous Plumes in LWIR Hyperspectral Imagery*", 2008, PNNL-17989, Pacific Northwest National Laboratory, Richland, WA.

M. F. Tardiff, and L. Chilton, "*Spectral Library Statistical Analysis Image Generation Plan For Algorithm Testing*", 2008, PNNL-17982, Pacific Northwest National Laboratory, Richland, WA.

S. J. Walsh, M. F. Tardiff, L. Chilton**,** and C. N. Metoyer, "*Effect of Background Emissivity on Gas Detection in Thermal Hyperspectral Imagery*", 2008, PNNL-17874, Pacific Northwest National Laboratory, Richland, WA.

L. Chilton and S. J. Walsh, "*Large Spectral Library Problem",* 2008, PNNL-17810, Pacific Northwest National Laboratory, Richland, WA.

A. S. Renholds, S. E. Thompson, K. K. Anderson, and L. Chilton, "*Comparison of Two Gas Selection Methodologies: An Application of Bayesian Model Averaging*", 2006, PNNL-15749, Pacific Northwest National Laboratory, Richland, WA.

Presentations:
M. F. Tardiff and L. Chilton**, "***Spectral Library Statistical Analysis - Mission Planning Approaches for HSI,"* Office of Nonproliferation Research and Development Remote Sensing Program Review Meeting, Eglin Air Force Base, FL, May 19, 2009.

L. Chilton, "*Bayesian Algorithms for Plume Analysis*," (Invited Speaker) SPIE Defense and Security Conference, Orlando, FL, March 18, 2008.

R. T. Brigantic and L. Chilton, "*Classifying Hyperspectral Imagery via a Novel Method for Augmentation by Contextual Information*," Institute for Operations Research and the Management Sciences Annual Meeting 2007, Seattle, WA (November 2007).

L. Chilton, "*Markov Chain Monte Carlo Methods for Image Analysis*", Pacific Northwest National Labs, Statistical and Mathematical Sciences Division, Richland Washington, September 21, 2004

L. Chilton, "*Weapon System Modeling With Uncertainty – Two Examples*", Invited Speaker, Pacific Northwest National Labs, Statistical and Mathematical Sciences Division, Richland Washington, June 8, 2004

L. Chilton, "*hp Finite Element Methods*", Invited Speaker, Math Department Colloquium, Brigham Young University, Provo Utah, January 6, 2004

L. Chilton, "*Stable Finite Element Methods*", Invited Speaker, Math Department Colloquium, Texas Tech University, Lubbock Texas, November 29, 2001

L. Chilton, "*Domain Decomposition and Mortar Finite Elements*", AFOSR Contractors/Grantees Meeting Computational and Applied Mathematics, Stanford University, July 25, 2001

L. Chilton, "*Mixed Methods with Mortar Elements for Stokes Flow*", Math Department Colloquium, Air Force Institute of Technology, May 2001

L. Chilton, "*Orthogonal Polynomials*", Math Department Colloquium, Sinclair Community College, October 2000

L. Chilton, "*Spatial (Eulerian) Formulation for Nearly Incompressible Elasticity*", AFOSR Contractor and Grantees Meeting, Stanford University, June 2000

L. Chilton, "*Stable Curvilinear p-version Elements for Mixed Formulations of Elasticity*", Math Department Colloquium, Air Force Institute of Technology, Apr 2000

L. Chilton, "*Orthogonal Finite Elements*", Math Department Colloquium, Air Force Institute of Technology, April 1998

L. Chilton, "*Locking-free Mixed hp Finite Element Methods*", Math Department Colloquium, Air Force Institute of Technology, October 1997

L. Chilton, "*Mixed hp Elements for Linear and Geometrically Nonlinear Elasticity*", Semi-Annual Finite Element Conference, Courant Institute, New York City, NY, April 1997

L. Chilton, "*Numerical Stability of Finite Element Methods*", Graduate Student Research Day, University of Maryland, Baltimore County, MD, May 1996

L. Chilton, "*Computational Analysis of Finite Element Methods for Nearly Incompressible Linear Elasticity*", Semi-Annual Finite Element Conference, University of Maryland, Baltimore County, MD, October 1995

Students:
Roger A. Erich, MS, "*A sampling and transformation approach to solving random differential equations*", March 2005, Committee Chair

Susan E. Bettison, MS, "*Noise Estimation in the presence of BPSK digital burst transmissions",* March 2005, Committee Chair

Daniel R. Millman, PhD, "*Predicting subcritical and supercritical responses of a pitch and plunge airfoil with a stochastic projection method*", August 2004, Committee Member

Daniel E. Gisselquist, PhD, "*A probabilistic model for deriving cyclostationary signal processing algorithms*", March 2004, Committee Member

Thomas Hopkins, MS, "*Stochastic intra-cellular modeling*", September 2003, Committee Member

Jacqueline B. Young, MS, "*Deterministic intra-cellular modeling*", March 2003, Committee Member

Michael A. Saville, MS, "*Investigation of conformal high-impedance ground planes*", March 2000, Committee Member

Perry N. Villaneuva, MS, "*Application of the finite element method to the scattering of a two-dimensional semi-infinite periodic structure*", March 1999, Committee Member

Matthew D. Craig, MS, "*An empirical prediction model of tolerance effects on frequency selective surfaces using the Monte Carlo method*", March 1999, Committee Member

Jeffrey M. Hemmes, MS, "*Modeling chemical absorption through membranes*", March 1999, Committee Member