

# CURRICULUM VITAE

## Gary W. Howell

512 Farmington Woods Dr.,  
Cary, NC 27511

Phone: (919) 469-5454.  
Email: gary\_howell@ncsu.edu

### EDUCATION

<b>Ph. D. Mathematics</b> , University of Florida, Gainesville, FL	1986
<b>M. Sc. Engineering Sciences</b> , University of Florida	1984
<b>M. Sc. Mathematics</b> , University of Florida	1981
<b>B. A. Mathematics</b> , New College, Sarasota, Florida	1973

### RESEARCH INTERESTS

Parallel Software, Numerical Analysis, Linear Algebra, and Approximation Theory.

Algorithms Developed:

- Piecewise Circular Splines
- BHESS reduction of square matrices to similar banded upper Hessenberg form.
- BR iteration to find Eigenvalues of the BHESS produced matrices.
- ELMRES to solve sparse systems of linear equations.
- BLAS 2.5 algorithms included in the BLAS standard.
- BLAS 2.5 Householder bidiagonalization sparse and dense.
- Block Householder reduction of sparse matrices to banded upper triangular form.

Other:

- Developed Method to Separate Isotopes by Oscillatory Flow.
- Generalized Cauchy's Error bound for polynomials to apply to polynomial derivatives.

### PROFESSIONAL EXPERIENCE

2004 – present **High Performance Computing Software Consultant**,  
Office of Information Technology.  
North Carolina State University, Raleigh, NC

2002 – 2004 **High Performance Computing Software Consultant**.  
U.S. Army Engineer Research and Development Center (ERDC)  
Major Shared Resource Center (MSRC)  
Hewlett Packard Corp, Vicksburg, MS

2001 – 2002 **Professor of Mathematical Sciences**  
Florida Tech, Melbourne, FL

2001 **Summer Visiting Researcher**

- CERFACS, Toulouse, France
- 2001 – 2002 **Senior Scientist Consultant Image Processing Algorithms**  
Harris Corporation, Melbourne, FL
- 1997 – 2000 **Operations Research Faculty**  
Florida Tech, Melbourne, FL
- 1991 – 2000 **Associate Professor of Applied Mathematics**  
Florida Tech, Melbourne, FL
- Spring 1997 **Visiting Professor of Mathematics**  
Washington State University, Pullman, WA
- 1991 – 1996 **City Commissioner**  
Town of Melbourne Village, FL
- 1993 – 1998 **Chair of Public Works Committee**  
Town of Melbourne Village, FL
- 1996 – 1999 **Computer Science Faculty**  
Florida Tech, Melbourne, FL
- 1994 – 1995 **Summer Faculty Fellowship Researcher**  
Oak Ridge National Laboratory, Oak Ridge, TN
- 1987 – 1990 **Engineering Consultant**  
Thiokol Corporation, Kennedy Space Center, FL
- 1986 – 1991 **Assistant Professor of Applied Mathematics**  
Florida Tech, Melbourne, FL

## INVITED TALKS

- Aug. 2009 WG-2.5 Symposium, NC State University, “Block Householder Reduction of Sparse Matrices”. Presented three similar talks to the Copper Mountain Conference on Multigrid Methods 2009, CO; to SIAM Parallel Computing 2008 in Atlanta, GA, and to Numerical Analysis Seminar at NC State in May 2009.
- Apr. 2009 SIAM student chapter, NC State University, "HPC at NCSU."
- Feb. 2007 NIST Workshop, “Computational Efficiency.”
- 2003 Multi-Grid Seminar sequence at ERDC MSRC.
- Feb. 2002 Compaq HPC group, Framingham, MA. “Sparse Householder Bidiagonalization.”
- Jun. 2001 CERFACS, Toulouse, France, Sparse Days Conference. “Sparse Householder Bidiagonalization.”

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- Sep. 2000 CERFACS, Toulouse, France, “The ELMRES algorithm for solving sparse non-symmetric linear systems.”
- Jul. 2000 ICCAM, Leuven, Belgium, “Cache-Efficient Bidiagonalization.”
- Oct. 1998 Basic Linear Algebra Standards National committee (BLAST Forum).
- Jun. 1998 Basic Linear Algebra Standards National committee.
- Dec 1997 Basic Linear Algebra Standards National committee (BLAST Forum).
- Oct. 1997 SIAM Conference on Applied Linear Algebra at Snowbird, Utah. Mini symposium presentation “Gaussian Similarity Transformations In Computing Matrix Eigenvalues.”
- Apr. 1997 Washington State University, Mathematics Colloquium, “Large Eigenvalue Problems.”
- Jul. 1995 Oak Ridge National Labs, “BR Iteration.”
- Jul. 1994 Oak Ridge National Labs, “BHESSE Reduction to Small Band Form.”
- Nov. 1994 University of Central Florida Mathematics Seminar, “Efficient Computation of Eigenvalues.”
- Mar. 1993 University of Central Florida Mathematics Seminar, “Quasi-Circular Approximation.”
- Nov. 1992 Quantum Mechanics Seminar, University of Florida, “Efficient Computation of Eigenvalues.”
- Nov. 1991 University of Central Florida Mathematics Seminar, “Error Bounds for Derivatives of Interpolating Polynomials.”

### **FUNDED RESEARCH**

- 2005 – 2007 Senior Scientist for \$385,000 “Comparative and Web-Enabled Virtual Screening (RMI)” NIH Molecular Libraries Roadmap for Medical Research, Grant 1 P20 HG2003900-01.
- 2001 Co-PI of \$250,000 NSF MRI for a Beowulf Cluster at Florida Tech.
- 2001 – 2004 PI of \$104,000 NSF Next Generation Software for BLAS 2.5 Householder Bidiagonalization, EIA-0103642.
- 1994 – 1995 Summer Faculty Fellowship at Oak Ridge National Laboratory to develop algorithms to reduce a general matrix to similar small band form and to efficiently determine Eigenvalues.
- 1991 – 1992 Co-PI of a \$100,000.00 National Science Foundation grant to study parallel algorithms.
- 1991 – 1992 PI of a \$13,000 Florida Solar Energy Commission grant to study isotope separation.

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- 1990 PI of a \$20,000 FL TRDA grant to study Convection Diffusion problems.
- 1990 PI of a \$30,000 Thiokol Corporation contract to determine thermal heating of Atlas thruster during re-entry.
- 1987 – 1988 PI of a \$30,000 Morton Thiokol contract to analyze the piecewise circular spline algorithm.

## TEACHING EXPERIENCE

NC State University:

Short Courses on MPI, OpenMP and Use of Debuggers.

CSC 783 (MA 783) "Parallel Algorithms & Scientific Computing" in fall 2004.

ECRDC MSRC:

Organized sequences of Numerical Analysis seminars.

Florida Tech:

Frequently taught Numerical and Parallel Algorithms, in Math and CS.

Organized Numerical Analysis seminars.

Over 70 thesis and dissertation committees in Math, Computer Science, Operations Research and various Engineering and Science disciplines.

Math Theses Supervised:

"Potential for High Performance Distributed Computing Utilizing the Java Language", Jason Edelblute, 2000.

"The ELMRES Method for Solving Systems of Sparse Linear Equations", dissertation by Desmond Stephens, 1999.

"Evolution of Currents in the Surf Zone: A Numeric Approach, David McLaughlin, 1996.

"A Non-Parametric Statistical Analysis of the Physical Characteristics of Wide Binary Star Systems", Barbara Jones Smith, 1993.

"Solving a Detection-Estimation Problem Using the Least-Squares Method", Kimberley Wilkinson, 1993.

"Generated Closed Shapes with Circular Splines: A Least Squares Approach to Closure", John Karp, 1991.

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“Solution of a System of Nonlinear Equations as Related to Circuit Simulation”, Tina Najibi, 1989.

Computer Science Theses Supervised:

"Parallelization of BLAS 2.5", Sumit Malhotra, 2003.

"Application of Scheduling Theory to Spacecraft Constellations", Christopher Graham, 2000.

"Storage and its Management", Cary Godwin, 2000.

## **PROFESSIONAL MEMBERSHIP**

SIAM, AMS, and ACM

## **PROFESSIONAL SERVICE**

### **National Computational Science Standards Committees:**

MPI (Message Passing Interface) Forum

BLAST (Basic Linear Algebra Subroutines) committee

### **Florida Tech**

CS examination committee outside member (1995-98)

President of Brevard Chapter of Sigma Xi (1998-99)

Faculty Senate (1999-2002)

### **Refereeing:**

National Science Foundation proposals

Oxford University Press

Wiley & Sons publishers

Journal of Applied Mathematics and Computation

Journal of Applied Mathematics and Simulation

Journal of Approximation theory

Simon & Schuster

Morgan & Kaufman

Approximation Theory and its Applications

Journal of Applied Mathematics and Stochastic Analysis

Journal of Computational and Applied Mathematics

Indian Journal of Pure and Applied Mathematics

Rocky Mountain Journal of Mathematics

Book reviews for JAMSA

## **HOBBIES**

Enjoy playing the Piano, Clarinet and Tenor Sax. Jogging, hiking & bird watching. Enjoy reading and going to the opera when possible. Also enjoy playing volleyball.

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## PUBLICATIONS

### Numerical Analysis and Parallel Computation

G. W. Howell, C. T. Fulton, K. Marmol, J. Demmel, and S. Hammarling, "Cache Efficient Bidiagonalization Using BLAS 2.5 Operators", *ACM Transactions on Mathematical Software* 32, 3, pp. 13-46 (May 2008).

G.W. Howell and N. Diaa, Algorithm 841, "Gaussian Reduction to a Similar Banded Hessenberg Form", *ACM Transactions on Mathematical Software* 31, 1, pp. 166-195 (March 2005).

Desmond Stephens and Gary Howell, "The Elementary Residual Method", *AMS Contemporary Mathematics* 275, pp. 107-116 (2001).

P. Godfrey and G. Howell, "A three term recurrence for Bernoulli, Genocchi, and Euler Numbers", *Bulletin of the Marathwada Mathematical Society* 2, pp. 33-37 (Dec. 2001).

G. A. Geist, G. W. Howell, and D.S. Watkins, "The BR Eigenvalue Algorithm", *SIAM J. on Matrix Analysis and Applications (SIMAX)* 20, 4 pp. 1083-1097 (July 1999).

V. Lakshmikanthan, S. K. Sen, and G.W. Howell, "Vectors vs. Matrices, p-inversion, cryptographic applications, and vector implementation", *Neural, Parallel & Scientific Computations* 4, 2, pp. 129-140 (June 1996).

G. W. Howell and K. Rekab, "Expected Conditioning for Eigenvalues of Randomly Generated Matrices", *Neural, Parallel, and Scientific Computations* 3, 2, pp. 263-270 (June 1995).

Gary. W. Howell, "Efficient Computation of Eigenvalues of Randomly Generated Matrices", *Applied Mathematics and Computation* 66, pp. 9-24 (1994).

S.K. Sen and Gary Howell, "Direct Fail-Proof Triangularization Algorithms for  $AX + XB = C$  with Error-Free and Parallel Implementations", *Applied Mathematics and Computation* 50, pp. 255-278 (1992).

### Approximation Theory

Gary Howell, L.V. Fausett, and D. Fausett, "Quasi-Circular Splines, a Shape Preserving Algorithm", *CVGIP: Graphical Models and Image Processing* 55, 2, pp. 89-97 (1993).

Gary Howell, "Derivative Error Bounds for Lagrange Interpolation", *Journal of Approximation Theory* 67, 2, pp. 164-173 (1991).

Gary Howell and A. K. Varma, "0-2 Spline Interpolation With Quartic Splines", *Numeric Functional Analysis and Optimization* (1991).

Gary Howell, "Optimal Error Bounds for Two Even Degree Tridiagonal Splines," *Journal of Applied Mathematics and Simulation* 3, pp. 117-134 (1990).

Gary Howell and A. K. Varma, "Best Error Bounds for Quartic Spline Interpolation", *Journal of Approximation Theory* 58, 1 (July 1989).

A. K. Varma and Gary Howell, "Best Error Bounds for Derivatives in Two Point Birkhoff Interpolation Problems", *Journal of Approximation Theory* 38, 3 (July 1983).

### **Differential Equations**

K. N. Murty, Gary Howell, and S. Sivasundaram, "Two Point Boundary Value Problems associated with a System of First Order Non Linear Impulse Differential Equations", *Applicable Analysis* 51, pp. 303-313 (1993).

K. N. Murty, G.W. Howell and S. Sivasundaram, "Two (multi) Point Nonlinear Lyapunov Systems, Existence and Uniqueness", *Journal of Mathematical Analysis and Applications*, pp.505-515 (July 1992).

Gary Howell and V. Laskhmikantham, "A New Monotone Iterative Technique for Solution of Nonlinear Systems of Differential Equations", *Applicable Analysis* 39, pp. 113-118 (1990).

### **Fluids**

Gary Howell, Pavlos Kairis, and Kamel Rekab, "Monte Carlo Simulation of Dispersion in Slow Oscillatory Flow", *Journal of Mathematics and Physical Sciences* 27, 4, pp.257-269 (1993).

Gary Howell, "Isotope Separation by Oscillatory Flow", *Physics of Fluids* 31, 6 (1988).

U. H. Kurzweg, G. W. Howell and M. J. Jaeger, "Enhanced dispersion in oscillatory flows", *Physics of Fluids* 27, 5 (1984).

## **TECHNICAL REPORTS AND CONFERENCE PROCEEDINGS**

### **Numerical Analysis**

V. Bannister, G. W. Howell, C.T. Kelley, E. Sills and Q. Zhang, "A Case Study in Using Local IO and GPFS to Improve Simulation Scalability", *Linux Cluster Institute Conference*, Tahoe, Calif. (May 2007).

G. W. Howell, C. T. Fulton, K. Marmol, J. Demmel, and S. Hammarling, "Cache Efficient Bidiagonalization Using BLAS 2.5 Operators", *LAPACK Working Note (LAWNS)* 174 (2003).

Gary Howell, "Using SHMEM for Low-Latency Communication on the Compaq SC40 and SC45", *The Resource*, U.S. Army Engineer Research and Development Center, Information Technology Laboratory, pp. 30-31 (Fall 2003).

P. Angeli, O. Basset, C. Fulton, G. Howell, R. Hsu, A. Sawetprawchichkal, M. Schuster, D. Richardson, H. Thompson, S. Wilberscheid, "Some Issues in Efficient Implementation

of a Vector Based Model for Document Retrieval”, 2001 International Symposium on Information Systems and Engineering, Las Vegas (2001).

G.W. Howell, G.A. Geist, and T.H. Rowan, “Error Analysis of Reduction to Similar Banded Hessenberg Form”, Oak Ridge Technical Report ORNL/TM-13334 (March 1998).

Gary W. Howell, “Towards an Efficient and Stable determination of spectra of a general matrix and a more efficient solution of the Lyapunov equation”, Proceedings of the First World Congress of Nonlinear Analysts IV, pp. 3913-3927, Tampa, Walter de Gruyter (1996).

G. W. Howell and G. A. Geist, “Direct Reduction to a Near-Tridiagonal Form”, Proceedings of the ISCA 8th International Conference on Parallel and Distributed Systems, pp. 426-432 (1995).

G. W. Howell and G. A. Geist, “Necessity of High Precision Arithmetic for Large-Scale Computation”, Proceedings of Neural, Parallel, and Scientific Computations 1, Atlanta (1995).

### **Approximation Theory**

Gary Howell, “Generalizations of the Cauchy Remainder”, Proceedings of International Conference on Conjectures in Approximation Theory, Sofia, Bulgaria (June 1993).

Gary Howell, “Conditioning of Lidstone Polynomial Interpolations”, Proceedings of 6th S.E. Approximation Theory Conference, (1991).

Gary Howell, “Shape Generation by Linear Deformation of Circular Splines”, Proc. 6th Texas A&M Conf. on Approximation Theory 1, pp. 333-336, Academic Press (1989).

Gary Howell, Donald W. Fausett and Laurene V. Fausett, “Mathematical Evaluation of Sine-Bar Measuring Device”, Morton Thiokol Technical Report, contract 7MF103 (1987).

### **Thermal Analysis**

Gary Howell, “A Finite Difference Routine for Solving Time-dependent Heat Flux for Composite Materials”, Thiokol Corporation Technical Report (April 1989).

J.I. Frankel, T.P. Wang, and G.W. Howell, “The Use of the Finite Integral Transform Technique for Thermal Analysis in Microelectronic Chip Modules”, 5th Int. Conf. on Numerical Methods for Thermal Problems, Montreal, Canada, (June 1987).

### **LINKS:**

[http://www.ncsu.edu/itd/hpc/Documents/Publications/gary\\_howell/contents.html](http://www.ncsu.edu/itd/hpc/Documents/Publications/gary_howell/contents.html)

<http://www.ncsu.edu/itd/hpc/Courses/Courses.php>