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**Mark A. Martin**

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**Objective**

A position in a scientific field utilizing my mathematical, scientific, and computer skills.

**Education**

2000 Ph.D. Applied Mathematics, University of Washington  
1992 M.S. Applied Mathematics, University of Washington  
1988 - 1989 Ph.D. Program in Applied Mathematics, University of Colorado in Denver  
1988 M.S. Mathematics, University of Arizona  
1986 B.A. Mathematics, University of Colorado in Boulder

**Dissertation Title**

The Influence of Seasonal and Climatic Environmental Changes on Plankton in the Marine Mixed Layer

**Research Topics**

Oceanography with Mark Kot (1993 - 2000) -- plankton ecology and physiology; dynamics of the marine mixed layer; climate change

Meteorology with Chris Bretherton (1990 - 1993) -- atmospheric boundary layer; contributed to large eddy simulation cloud model; mixed layer models of the troposphere; climate change

Numerical Analysis with Tom Manteuffel and Loyce Adams (1988 - 1990) -- preconditioned conjugate gradient methods for the numerical solution of elliptical partial differential equations

**Other Areas of Knowledge**

mathematical biology; dynamical systems, bifurcation theory, and chaos; perturbation theory; ordinary differential equations; partial differential equations; mathematical modeling; finite difference, finite element, and multigrid numerical methods; numerical linear algebra; approximation theory; other numerical methods: quadrature, interpolation, data fitting, solution of nonlinear equations, and FFTs; calculus of variations; probability; real analysis; complex analysis; functional analysis; topology; abstract algebra; differential geometry; marine microbiology

**Professional and Research Positions**

Computational Scientist (January 2001 - December 2001)

*Integrated Genomics, Inc* -- Chicago, IL

Software Development and Mathematical Modeling --- One of two lead designers in a team of five people creating software for mathematically modeling prokaryotic organisms as networks of metabolic reactions and for developing and maintaining the company's biochemical pathway collection. Supervised and participated in implementation.

Biochemical Pathway Collection --- Mediated disputes concerning the company's biochemical pathway collection. A leader of the effort to provide the infrastructure for using legacy tools and methods for developing and maintaining the pathway collection.

Systems Administration and Support --- Primary resource for Linux/UNIX systems design and support and computer security. Designed and implemented firewalls to stop crippling attacks. One of two primary developers of the procedure for quickly reproducing our primary bioinformatic product, which replaced a several-day-long, error-prone, manual process with an automatic process taking less than an hour. Designed and built systems, installed and updated software, performed backups, monitored systems for performance and security, assisted users and other administrators, and solved problems.

Human Resources --- Researched the market value of positions, located and interviewed candidates, made job offers, and negotiated salaries.

Scientific Programmer (April - May 2000)

*Boystown National Research Hospital, Audiological Research Department* -- Omaha, NE  
Extended, corrected, and improved STAR (Stimulus Treatment for Auditory Research), a tool for studying the elements of speech that are important to hearing. The tool aids in the development of better methods of assessing auditory dysfunction in children. The program consists of approximately 4500 lines of MATLAB code and is used under Microsoft Windows 95, 98, and 2000. It presents stimuli to subjects using animated games and is operated through a configuration file and a GUI.

Lead UNIX Systems Administrator (January 1997 - November 1997)

*Boeing Information and Support Services* -- Bellevue, WA

Lead administrator for a team of 7 administrators that maintained terabyte-scale Sequent Symmetry 5000 and NUMA-Q 2000 servers. Led a team of 8 administrators and technical services personnel in certifying hardware and software components of three new technologies for use at Boeing. Planned, supervised, and participated in hardware and software upgrades, hardware and software reconfigurations, new systems builds, troubleshooting, systems tuning, and routine maintenance activities. Trained junior administrators and interviewed prospective employees. Created and maintained Perl and Korn shell scripts for monitoring system integrity and performance, for controlling applications, and for creating the SVM (logical volume) objects needed to support databases.

UNIX Systems Administrator (September 1996 - December 1996)

*Boeing Information and Support Services* -- Bellevue, WA

Maintained Sequent Symmetry 5000 servers. Systems were 1, 2, or 3-node clusters with thousands of users, approximately a terabyte of disk space, and from a couple thousand to nearly 10,000 SVM (logical volume) objects. Developed Perl and Korn shell administrative scripts and Perl CGI scripts for monitoring system performance over the company's intranet. Completed all Sequent systems administration courses pertaining to the Symmetry 5000.

Assistant Systems Administrator (December 1995 - March 1996)

*University of Washington, Department of Applied Mathematics -- Seattle, WA*

Upgraded and installed software. Maintained and enhanced the department's web site. Assisted and instructed users. Conducted routine maintenance such as running backups, restoring lost files, and servicing printers.

NSF Graduate Research Traineeship in Mathematical Biology (March 1994 - June 1994)

*with Tom Daniel and Gary Odell, University of Washington, Department of Zoology*

Studied mathematical models of the hypothetical roles of plankton in regulating climate.

Scientific Programmer (Summer 1993)

*University of Washington, Department of Radiation Oncology -- Seattle, WA*

Implemented, optimized, and corrected portions of the dose calculation engine of Prism, the department's radiation treatment planning software, which went into clinical use a few months after I left. The dose calculation code was approximately 10,000 lines of Pascal. Ported the dose calculation code from Sun to HP workstations. Developed automated testing software to ensure that the code returned realistic values. Documented my work and flow-charted the dose calculation software to assist in future modifications. Helped create the protocols that client programs used to request and receive information from the dose calculation program and modified the program to conform to the protocols.

Research Assistant (September 1990 - August 1991)

*University of Washington, Department of Applied Mathematics -- Seattle, WA*

Wrote a multigrid poisson solver and code for dynamically regridding solution domains for a large eddy simulation cloud model.

Research Assistant (Summer 1990)

*University of Washington, Department of Applied Mathematics -- Seattle, WA*

Performed research on preconditioned conjugate gradient methods for solving the linear systems that arise from discretizing elliptical partial differential equations.

Research Assistant (January 1989 - May 1989)

*University of Colorado in Denver, Department of Mathematics -- Denver, CO*

Performed research on preconditioned conjugate gradient methods for solving the linear systems that arise from discretizing elliptical partial differential equations.

## Teaching Experience

### Teaching Assistant (Most quarters from Fall 1991 - Winter 1995)

*University of Washington, Department of Applied Mathematics -- Seattle, WA*

Assisted with graduate level courses in

- ordinary differential equations
- partial differential equations
- numerical solution of differential equations
- complex analysis
- nonlinear dynamics and chaos
- mathematical ecology
- applied linear algebra and numerical methods

and senior undergraduate level courses in

- vector calculus and complex variables
- ordinary differential equations
- partial differential equations

Created solution sets and graded homework papers and exams. Held office hours to help students with individual problems. Determined course grades.

### Teaching Assistant (Fall 1989 - Spring 1990)

*University of Washington, Department of Mathematics -- Seattle, WA*

Assisted with the first year of calculus. Created quizzes and solutions sets and graded homework papers, quizzes, and exams. Taught quiz sections where students discussed problems and took quizzes. Held office hours to help students with individual problems. Determined course grades.

### Teaching Assistant (Fall 1988)

*University of Colorado in Denver, Department of Mathematics -- Denver, CO*

Responsible for all aspects of two sections of business mathematics (linear algebra, difference equations, linear programming, probability, combinatorics) containing roughly 50 students each.

### Teaching Assistant (Fall 1986 - Spring 1988)

*University of Arizona, Department of Mathematics -- Tucson, AZ*

Responsible for all aspects of courses in calculus, algebra, and trigonometry. Tutored students learning algebra in large self-paced algebra program. Selected textbooks for use in lower division courses.

### Student Assistant (1984 - 1985)

*University of Colorado in Boulder, Department of Physics -- Boulder, CO*

Helped students perform experiments in freshman physics labs. Helped set up the laboratory before lab sections. Graded the students' lab notebooks.

## **Additional Experience**

### Contributor to the Development of Content (1997 - present)

Content is a graphical and computational environment for studying the bifurcations of equilibria and periodic solutions of nonlinear equations. Ported the software to a new platform, helped with testing and debugging, and contributed documentation on bugs, porting, and installation.

### Software Developer (1978 - present)

Authored or contributed to a wide variety of projects in many languages on many platforms. The projects have ranged from small programs in a single language to projects consisting of tens of thousands of lines of code in multiple languages. Have designed and written procedural and object-oriented programs, constructed graphical user interfaces and animations, and have written or participated in the development of distributed and parallel applications.

### Web Site Designer and Developer (1994 - present)

Designed and implemented my web site (mark-a-martin.us) and portions of the Department of Applied Mathematics web site at the University of Washington (www.amath.washington.edu). Created a web-based tool for remotely retrieving and graphically presenting UNIX system information. Proficient with a wide array of web servers, web browsers, graphics software, and web technologies.

### Linux Systems Administrator (1995 - present)

System configuration, management, kernel building, troubleshooting, installation. PC hardware replacement, configuration, troubleshooting, installation.

### Microsoft Windows Administrator (1993 - present)

Maintenance of Windows 3.x through XP. Y2K remediation for Windows 95, 98. PC hardware replacement, configuration, troubleshooting, installation.

## **Honors**

NSF Graduate Research Traineeship in Mathematical Biology - 1994

Graduate and Professional Student Senate - 1993 to 1994

Colorado Doctoral Fellowship - 1989

## **Professional Associations**

Society for Industrial and Applied Mathematics (SIAM)

American Geophysical Union (AGU)

## **Conferences**

2002 SIAM 50th Anniversary & Annual Meeting,

Philadelphia, PA

Attended the Short Course on Mathematical Models for Finance.

1997 Sequent Users Resource Forum (SURF),

San Diego, CA

1995 Workshop on Interactions Between Physical and Biological Systems in the Ocean, University of California at Berkeley, Berkeley, CA

1993 Northwest Workshop in Mathematical Biology,  
University of Washington, Seattle, WA

1992 Northwest Workshop in Mathematical Biology,  
University of British Columbia, Vancouver, B.C.

1989 Northwest Workshop in Numerical Analysis,  
Simon Fraser University, Vancouver, B.C.

1989 Copper Mountain Conference on Numerical Methods,  
Copper Mountain, CO

## **Presentations**

November 2000: "How Plankton Respond to Seasonal and Climatic Changes in the Marine Mixed Layer", Integrated Genomics, Inc., Chicago, IL

March 2000: Dissertation defense titled "The Influence of Seasonal and Climatic Environmental Changes on Plankton in the Marine Mixed Layer", University of Washington, Seattle, WA

1995 "How Plankton Respond to Sunlight and Mixed Layer Depth" at the Workshop on Interactions Between Physical and Biological Systems in the Ocean, University of California at Berkeley, Berkeley, CA

1994 Invited seminar "Mathematical Models of Plankton Populations" at the Applied Physics Laboratory of the University of Washington, Seattle, WA

1993 "Plankton, DMS, and Climate" at the Northwest Workshop in Mathematical Biology, University of Washington, Seattle, WA

1992 Invited lecture on plankton and climate at the University of Washington Summer Course in Oceanography at Friday Harbor, Friday Harbor, WA

1992 Master's Presentation titled "Chaos and Daisyworld", University of Washington, Seattle, WA

## **Notable Computer Projects**

2002

Package for generating and analyzing the simple cell mappings corresponding to systems of ordinary differential equations and graphically presenting the results (C using GNU Scientific Library, ATLAS, GNU libplot, and MPICH).

Features:

- Allows analysis of arbitrary-dimension, first-order systems of ODEs with arbitrary numbers of parameters.

- Allows use of any of the 10 ODE solvers of the GNU Scientific Library.

- Supports parallel computation of cell mappings on a Beowulf cluster using MPICH or serial computation of cell mappings on a single processor.

- Allows visualization of 2 or 3-dimensional slices of cell mappings. 3-dimensional slices are represented as movies of 2-dimensional slices along a user-specified line.

Allows generation and visualization of cell mappings along arbitrary curves through parameter space.

Graphical output may be generated in any of the 14 file formats that the GNU plotutils support. (The animation formats available for movies are pseudo-GIF and X11.)

Cell mapping is usually used to determine the global behavior of periodically-forced systems of ordinary differential equations.

Perl scripts for extracting data from Atmosphere-Ocean Model (AOM) archive files. The AOM is a general circulation model constructed at NASA GISS.

2001

A principal designer and participant in the development of software for mathematically modeling prokaryotic organisms as networks of biochemical reactions based on their genomes (3-tier application with a PostgreSQL database, Apache web server, and Java clients).

Perl scripts to migrate and consolidate data from legacy databases.

Perl scripts to transfer mathematical models of *E. coli* from the Internet into our software.

Perl and Bash scripts to automate legacy processes for maintaining the biochemical pathway collection.

Bash scripts for performing backups.

Miscellaneous administrative perl and Bash scripts.

1998 - 2000

Plotting tool and prototype interface for cell mapping (C with a Perl/Tk GUI front end). Cell mapping is a technique for globally analyzing dynamical systems.

Programs for creating bifurcation diagrams for systems of ordinary differential equations (C, Perl).

Perl module that provides an object-oriented interface to the graph program from the GNU Plotutils.

Perl modules and scripts and C code to extract and process data from Joint Global Ocean Flux Study (JGOFS) sites (specifically BATS, BBOP, and HOTS).

Perl and Bash scripts and C code for analyzing data from Levitus and da Silva climatologies of oceanographic and atmospheric quantities.

Perl script for creating and laying out contour plots using DISLIN and data files in MTV data format.

Perl and Bash scripts for creating and manipulating plots of data.

Linux administrative scripts (Perl, Bash).

STAR (Stimulus Treatment for Auditory Research). See the Scientific Programming position at Boystown National Research Hospital in the "Professional and Research Positions" section above for details.

1996 - 1997

Perl module for transferring directory trees via FTP. This provides a way of performing backups to a remote machine using a dial-up connection to the Internet.

UNIX administrative scripts for development and production environments at Boeing (Perl, Korn shell).

Web-based client-server tool for monitoring UNIX systems via the Boeing Intranet (Perl and CGI under NCSA httpd).

1992 - 1995

Global analysis of arbitrary-dimension, periodically-driven systems of ordinary differential equations via simple cell mapping (MATLAB).

Tools for creating bifurcation diagrams for ordinary differential equations (MATLAB, Maple).

Radiation treatment planning software. See the Scientific Programming position at the University of Washington, Department of Radiation Oncology in the "Professional and Research Positions" section above for details.

1988 - 1991

Implemented preconditioned conjugate gradient methods for solving elliptical partial differential equations using multigrid as a preconditioner (Fortran 77, MATLAB).

Multigrid and conjugate gradient poisson solvers (Fortran 77).

Implemented method for adaptive regridding of solution domains (Fortran 77 and MATLAB).

Course projects in numerical methods for solving ordinary and partial differential equations, numerical linear algebra, and approximation theory (Fortran 77 and MATLAB).

1986 - 1987

Numerical solution of ordinary differential equations (Turbo C under MS-DOS on IBM 386 PCs).

1978 - 1985

Animated demonstration of Lorentz contraction and time dilation in special relativity (Basic and assembly language on the Commodore 64).

Animated simulation of the detection of gravitational waves emitted from a binary star system (Basic and assembly language on Commodore 64 and Apple IIe).

Programs to analyze data from physics labs (Basic).

## **Technical Expertise**

Scientific Software: MATLAB, Maple, Mathematica, Content, SPSS, xmgrace/xmgr, Dislin, xfig, gnuplot, GNU plotutils, PV-Wave, pic, eqn, plotmtv, Sigma Plot, xgobi, LaTeX, Framemaker, FFTW, GNU Scientific Library



Programming Languages: Perl, Perl/Tk, C, C++, Korn Shell, Bash, Fortran 77, Pascal, MATLAB, Maple, Basic, Javascript

Web Technologies: HTML, HTTP, CGI, CSS, Javascript, Java

Protocols: TCP/IP, UDP, ICMP, FTP, HTTP

Operating Systems: UNIX (Dynix/ptx 4.1.x, 4.2.x, 4.3.x, and 4.4.x, IRIX 5.3 and 6.2, Tru64 UNIX, Digital UNIX, DEC ULTRIX, HPUX, Red Hat Linux 2.x - 7.x, Mandrake Linux 6.x - 9.x, Slackware Linux 4.x, and OpenBSD 2.8 and 2.9), Microsoft Windows 3.x, 95, 98, ME, 2000, XP, NT 3.51 and 4.0, MacOS

Databases: Oracle, PostgreSQL, SQL, relational database design

Hardware: Sequent NUMA-Q 2000 and Symmetry 5000, EMC Symmetrix 3430 Open Storage System, StorageTek 9710 Tape Library, DEC Alpha, DECstation 2100,3100, and 5000, x86 PC's, HP 735 and 715, Silicon Graphics Indy and Indigo2, Sun Sparc 2 and Sparc 20, Apple Iie through IMac

Graphics Software: GIMP, ImageMagick, xfig, gd, GD.pm, XV, POV-Ray, GNU plotutils, pstoeedit, LView Pro, CorelDraw, various paint tools

Web Servers: Apache 1.2.x, 1.3.x, 2.0.x; Netscape Commerce Server; NCSA httpd 1.2.x, 1.3.x

Web Browsers: Netscape Navigator 1.x-6.x, Microsoft Internet Explorer 1.x-6.x, Mozilla, Konquerer, NCSA Mosaic 1.x and greater, Amaya, lynx, links

## **Technical Training**

Sequent training in Systems Administration, Systems Tuning, SVM Administration, Clusters Administration, Systems Security, Dynix/ptx Internals, Dynix/ptx 4.4 Administration Differences, and SVM 2.0 Administration Differences.

Oracle training in Oracle 7 Database Administration.