Erich L Foster

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Research Interests

High Performance Computing, Finite Element Methods, Climate/Ocean Modeling, Computational Fluid Dynamics, Hydrogeology.

Education

Ph.D., Applied Mathematics **2013**
Virginia Tech Blacksburg, Virginia - United States
Thesis Topic: "Finite Elements for the Quasi-geostrophic Equations of the Ocean"
Advisor: Traian Iliescu

M.Sc., Mathematics **2009**
Virginia Commonwealth University Richmond, Virginia - United States
Thesis Topic: "An Agent Based Gene Flow Model for *Cornus florida*"
Advisor: David Chan

M.Sc., Hydrogeology **2006**
University of Nevada, Reno Reno, Nevada - United States
Thesis Topic: "An Improved Numerical Result for Henry's Problem of Seawater Intrusion"
Advisor: Stephen Wheatcraft

B.Sc., Applied Mathematics **2003**
University of Nevada, Reno Reno, Nevada - United States
Course work included: Numerical Analysis, Partial Differential Equations, Computer Science, Electric Circuits, Physics, Chemistry.

Honors and Awards

NUMERIWAVES Fellow **2013-2014**
SIAM CSE 4th BGCE Student Paper Prize Finalist **2013**

Skills

Operating Systems: Linux, OS X.

Programming: Python, `FORTRAN 95`, `C++`, `MPI`, `OpenMP`, Matlab, LaTeX, Perl, Java.

Software: FEniCS/DOLFIN, GMSH, Paraview, Matlab, COMSOL, Excel, MODFLOW, Aquifer Win32, ArcGIS 9.X.

Education Software: Blackboard, Scholar

Languages: English (Native), Spanish (Intermediate), German (Beginner)

Publications and Presentations

In Preparation:

[P4] D. Dutykh, **E. L. Foster**, R. Goix and E. Zuazua. "Optimization of three-dimensional water waves by moving bottom disturbances". *In preparation* (2014).

[P3] **E. L. Foster**. "Adaptive DNS/LES for the quasi-geostrophic equations of the ocean". *In preparation* (2014).

[P2] **E. L. Foster** and J. Jansson. "A stable equal order finite element pair for the shallow water equations of the ocean". *In preparation* (2014).

[P1] **E. L. Foster** and J. Jansson. *AFES– Automated Finite Element Solver*. Tech. rep. 2014.

Refereed Publications:

[R6] **E. L. Foster**, D. Chan and R. Dyer. "Gene flow modeling by correlated random walk". *In revision* (2014).

[R5] **E. L. Foster**, T. Iliescu and D. R. Wells. "A conforming finite element discretization of the streamfunction form of the quasi-geostrophic equations". *In revision* (2014). URL: `http://arxiv.org/abs/1405.7836`.

[R4] **E. L. Foster** and J. Jansson. "Automated error control in finite elements for time-dependent problems". *Submitted* (2014).

[R3] **E. L. Foster**, J. Lohéac, M.-B. Tran and E. Zuazua. "A structure preserving scheme for Kolmogorov-Fokker-Planck equation". *Submitted* (2014). URL: `http://arxiv.org/abs/1411.1019`.

[R2] **E. L. Foster**, T. Iliescu and Z. Wang. "A finite element discretization of the streamfunction formulation of the stationary quasi-geostrophic equations of the ocean". *Computer methods in applied mechanics and engineering* 261-262(0) (2013), pp. 105–117. DOI: `10.1016/j.cma.2013.04.008`.

[R1] **E. L. Foster**, T. Iliescu and D. R. Wells. "A two-level finite element discretization of the streamfunction formulation of the stationary quasi-geostrophic equations of the ocean". *Computers & mathematics with applications* 66(7) (2013), pp. 1261–1271. DOI: `10.1016/j.camwa.2013.07.025`.

Invited Talks:

[I4] E. L. Foster. Center for Computational Medicine in Cardiology. University of Lugano. Lugano, Switzerlan, 2015.

[I3] E. L. Foster. Computer Technology Laboratory Seminar. KTH Royal Institute of Technology. Stockholm, 2013.

[I2] E. L. Foster. Computational Science and Engineering. SIAM. Boston, MA, 2013.

[I1] E. L. Foster. Computer Science and Mathematics Division Seminar. Oak Ridge National Laboratory. Oak Ridge, TN, 2012.

Contributed Talks:

[C8] E. L. Foster. BCAM Workshop on Computational Mathematics. Bilbao, Spain: Basque Center for Applied Mathematics, 2014.

[C7] E. L. Foster. SIAM Student Conference. SIAM. Clemson, SC: Clemson/Pitt/UTK/VT, 2013.

[C6] E. L. Foster. Fall Western Section Conference, Special Session of Geophysical Fluid Dynamics. AMS. Tucson, AZ, 2012.

[C5] E. L. Foster. Southeastern Atlantic Regional Conference on Differential Equations. Wake Forest, NC: Wake Forest University, 2012.

[C4] E. L. Foster. Student Conference. SIAM. Blacksburg, VA: Virginia Tech, 2012.

[C3] E. L. Foster and J. R. Overfelt. Student Intern Program Poster Session. Sandia. Albuquerque, NM, 2012.

[C2] E. L. Foster. Student Chapter Colloquium. SIAM. Blacksburg, VA: Virginia Tech, 2011.

[C1] E. L. Foster, S. W. Wheatcraft and A. S. Telyakovskiy. Poster Presentation. AGU. San Francisco: AGU Fall Meeting, 2005.

Student Advising

Robin Goix **2014**
Basque Center for Applied Mathematics Bilbao, Basque Country - Spain
Graduate Student Intern

Teaching Experience

Intro to LaTeX (BCAM Short Course) **November 2014**
Short course covering the most basic ideas on how to create LaTeX documents. This will included:

LaTeX document structure; Basic LaTeX document classes; Special characters, i.e. Mathematical symbols, non-English characters, etc.; Basic LaTeX environments, e.g. equations, tables, figures, etc.; How to reference tables, figures, sections, equations etc.; How to create a bibliography and cite a reference; BEAMER.

Calculus I (VT MATH 1205) **Fall 2010, Spring 2011**
This course includes subjects such as: limits, continuity, and differentiation.

Vector Geometry (VT MATH 1224) **Fall 2009, Spring 2010, Spring 2013**
This course is designed to teach students the basics required for Vector Calculus. Topics include analytic geometry and conic sections, and the calculus of vector-valued functions.

Precalculus and Trig (UNR MATH 128) **Fall 2003, Spring 2004**
This course is an introductory course in trigonometry which includes subjects such as: polynomials, graphing, trigonometric functions, etc.

Contemporary Math (VCU MATH 131) **Spring 2008**
This course is intended for non Science/Engineering majors. Topics include: optimization problems, and mathematics with applications in areas of social choice. Major emphasis is on the process of taking a real-world situation, converting the situation to an abstract modeling problem, solving the problem and applying what is learned to the original situation.

Professional Experience

Basque Center for Applied Mathematics Bilbao, Basque Country - Spain
Postdoctoral Fellow in CFD Computational Technology **2013 – present**
Automated finite elements, including goal-oriented adaptive finite elements and adaptive DNS/LES.

Virginia Tech Blacksburg, Virginia - United States
Teaching Assistant **2009 – 2011, 2013**
- Math 1205: Calculus I Fall 2010, Spring 2011
- Math 1224: Vector Geometry Fall 2009, Spring 2010, Spring 2013

Research Assistant **2011 – 2012**
Developed a C^1 conforming FE formulation of the Pure Streamfunction form of the Quasigeostrophic Equations. Developed an optimal error estimate for a high order finite element discretization (Argyris Finite Element) of the Pure Streamfunction formulation of the Quasigeostrophic Equations.

Sandia National Labs Albuquerque, New Mexico - United States
Graduate Student Intern **Summer 2012**
Developed a polygon clipping algorithm, which effectively dealt with degeneracies, for use in the Community Climate System Model (CCSM). The associated FORTRAN code was developed to take advantage of High Performance Computing/Parallel Computing.

Virginia Commonwealth University Richmond, Virginia - United States
Research Assistant **2008 – 2009**
Developed an agent based model to simulate the gene flow in *Cornus florida*.

Teaching Assistant **2008**
- Math 131: Contemporary Math Spring 2008

Virginia DEQ Richmond, Virginia - United States
Groundwater Modeller **2006 – 2008**
Analyzed regional aquifer response to groundwater withdrawals, calculating areas of impact and the response of the seawater toe, along the Coastal Plane and Eastern Shore of Virginia using MODFLOW and SHARP (a sharp interface seawater intrusion model).

INTERA Inc. Las Vegas, Nevada - United States
Groundwater Modeller **2005 – 2006**
Wrote scripts to parse out and collect data for pre and post processing of Monte Carlo simulations of large scale flow and transport models, for the DOE's Nevada Test Site, across multiple computer nodes.

University of Nevada, Reno Reno, Nevada - United States
Research Assistant **2004 – 2005**
Developed code to solve the Henry's Problem of Seawater Intrusion.

Teaching Assistant **2003 – 2004**
- Math 128: Precalculus and Trigonometry Fall 2003, Spring 2004

Mathematics Tutor **2000 – 2003**
Tutored all levels of undergraduate mathematics including: Trig and Algebra, Calculus, Differential Equations, Linear Algebra, Statistics, and Mathematical Modelling.

United States Navy Norfolk, Virginia - United States
Nuclear Electrician's Mate **1996 – 1998**
Operated the electrical plant and propulsion system aboard a nuclear submarine; maintaining proper load balance, and preventing loss of power.

Professional Societies

Society for Industrial and Applied Mathematics (SIAM)
American Mathematical Society (AMS)
Mathematical Association of America (MAA)