

Kenny Gruchalla

Curriculum Vitae

Personal Information

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Education

2009 **Ph.D. Computer Science**, *University of Colorado at Boulder*, Boulder, CO.
Thesis: Progressive Visualization-Driven Multivariate Feature Definition and Analysis
Advisor: Professor Elizabeth Bradley
GPA: 3.9/4.0

2003 **M.S. Computer Science**, *University of Colorado at Boulder*, Boulder, CO.
Thesis: Immersive Well-Path Planning: Investigating the added value of immersive visualization
Advisor: Professor Clayton Lewis
GPA: 3.9/4.0

1995 **B.S. Computer Science**, *New Mexico Institute of Mining and Technology*, Socorro, NM.
GPA: 3.5/4.0

Experience

National Renewable Energy Laboratory (NREL), Golden, CO (June 2009 - present)

Jun 2009 - present **Senior Scientist.**
I lead NREL's scientific data visualization efforts in support of renewable energy research, collaborating with NREL domain scientists in the visualization of complex, large, multivariate data.

University of Colorado at Boulder, Boulder, CO (April 2001 - present)

May 2011 - present **Assistant Professor Adjunct,**
Department of Computer Science.
I conduct research and oversee student research in scientific data visualization.

Apr 2001 - Mar 2006 **Professional Research Assistant,**
CADSWES (Center for Advanced Decision Support for Water and Environmental Systems).
I worked in an interdisciplinary research center on the design and the development of a commercial graphically-based decision support software system implementing object-oriented simulation, rule-based simulation, and linear optimization to model watershed physical processes, water ownership, and policy.

Jan 2004 - Aug 2004 **Professional Research Assistant,**
Department of Molecular, Cellular, and Developmental Biology.
I collaborated on the design and development of a pilot study to investigate the added value of using immersive visualization as a molecular research tool.

Jul 2002 - Aug 2003 **Graduate Research Assistant,**
BP Center for Visualization.
I designed and developed an interactive 3D immersive application capable of integrating geological, geophysical, reservoir and well data with drilling and platform planning in an immersive virtual environment.

Red Canyon Engineering, Denver, CO (June 2000 - January 2011)

Jun 2003 - Jan 2011

Research Scientist / Principal Software Engineer.

Jun 2000 - Jun 2003

Software Engineering Consultant.

I authored SBIR and other new business proposals, developing and directing over \$0.5M in grants and contracts. I also conducted software architecture and algorithm reviews for the Mars Odyssey and Genesis spacecraft programs.

National Center for Atmospheric Research (NCAR), Boulder, CO (May 2006 - October 2008)

May 2006 - Oct 2008

Visitor Appointment.

I collaborated on the design and development of VAPOR, a state-of-the-art volume visualization suite designed to interactively explore large-scale time-varying multivariate computational fluid dynamics (CFD) data.

Raytheon, Aurora, CO (July 1995 - February 2001)

Jul 2000 - Feb 2001

Senior Analyst / Medical Officer,

United States Antarctic Program

Raytheon Polar Services.

I managed the data acquisition and visualization laboratory aboard the National Science Foundation's Antarctic research vessel, the Nathaniel B. Palmer, providing scientific support to NSF grantees. I also sailed as Medical Officer (EMT) aboard the Palmer.

Oct 1997 - Jun 2000

Technical Software Lead,

Space and Science Systems, Raytheon Systems Corporation.

I designed and developed animated meteorological visualization tools for the Cape Canaveral and Vandenberg space lift ranges that included the development of both real-time and analysis visualization algorithms and image processing software for radar and satellite instrumentation. As the technical lead I served as technical mentor, providing technical guidance across projects and organizations.

Jul 1995 - Oct 1997

Software Developer,

Satellite Mission Management Organization, Hughes Space Systems (purchased by Raytheon in 1997).

I designed and developed a distributed satellite mission planning and scheduling software system that included interactive 2D computer graphic models of satellite and ground station resource allocation and 3D modeling tools used for satellite payload constraint analysis. I also helped design, develop, and maintain object-oriented class libraries designed for reuse and rapid development of satellite space and ground applications.

Brookhaven National Laboratory (BNL), Upton, NY (January 1994 - May 1994)

Jan 1994 - May 1994

Science and Engineering Research Intern,

Advanced Technology Division.

I designed and developed interactive 2D visualizations of subsurface radioactive waste plumes created by a physically-based model of the breach, leach, and transport of radioactive waste material.

Funding

January 2013

Integrated Energy Management and Analysis for the ESIF's Computational Systems, **Co-PI**
\$588K, DOE/NREL LDRD

September 2012

Novel Visualization and Analysis for Extreme-Scale Wind Turbine Array Simulations, **PI**
\$599K, DOE/NREL LDRD

September 2010

Wind Turbine Array Fluid Dynamic and Aero-Elastic Simulations, **Co-PI**
\$971K, DOE/NREL LDRD

January 2009

Lunar Base Simulator, **PI**
\$202K, NASA Glenn Research Center

November 2005

MarsFlight – An Immersive and Interactive Mars Airplane Simulator Phase II, **Co-PI**
\$126K, NASA Glenn Research Center

March 2005

MarsFlight – An Immersive and Interactive Mars Airplane Simulator Phase I, **Co-PI**
\$32K, NASA Glenn Research Center

Publications

Refereed Papers:

- M. Lunacek, A. Nag, D. Alber, K. Gruchalla, C.H. Chang, and P.A. Graf. Simulation characterization and optimization of metabolic models with the high-performance systems biology toolkit. *SIAM Journal on Scientific Computing*, 33, pages 3402-3424.
- K. Gruchalla, M. Rast, E. Bradley, and P. Mininni. Segmentation and visualization of multivariate features using feature-local distributions. In *Advances in Visual Computing*, volume 6938 of *Lecture Notes in Computer Science*, pages 619–628. Springer Berlin / Heidelberg, 2011.
- M.A. Sprague, P.J. Moriarty, M.J. Churchfield, K. Gruchalla, S. Lee, J.K. Lundquist, J. Michalakes, and A. Purkayastha. Computational modeling of wind-plant aerodynamics. In *Proceedings of SciDAC 2011, Denver, CO, 2011. Invited paper*.
- M. Guy, P. Earle, C. Ostrum, K. Gruchalla, and S. Horvath. Integration and dissemination of citizen reported and seismically derived earthquake information via social network technologies. In *Advances in Intelligent Data Analysis IX*, volume 6065 of *Lecture Notes in Computer Science*, pages 42–53. Springer Berlin / Heidelberg, 2010.
- J. Clyne, K. Gruchalla, and M. Rast. VAPOR: Visual, Statistical, and Structural Analysis of Astrophysical Flows. In *Proceedings of Numerical Modeling of Space Plasma Flows: Astronom-2009 (Astronomical Society of the Pacific Conference Series)*, volume 429, pages 323-329, 2010.
- K. Gruchalla, M. Rast, E. Bradley, J. Clyne, and P. Mininni. Visualization-driven structural and statistical analysis of turbulent flows. In *Advances in Intelligent Data Analysis VIII*, volume 5772 of *Lecture Notes in Computer Science*, pages 321–332. Springer Berlin / Heidelberg, 2009.
- K. Gruchalla, M. Dubin, J. March, and E. Bradley. Immersive examination of the qualitative structure of biomolecules. In *Proceedings of International Workshop on Qualitative Reasoning about Physical Systems*, pages 36–41, 2008.
- K. Gruchalla, J. Marbach, and M. Dubin. Porting legacy applications to immersive virtual environments - a case study. In *Proceedings of International Conference on Computer Graphics Theory and Applications (GRAPP 2007)*, pages 179–184, 2007.
- K. Gruchalla. Immersive well-path editing: investigating the added value of immersion. In *Proceedings of IEEE Virtual Reality, 2004.*, pages 157 – 164, March 2004.

Video (selected):

- K. Gruchalla, M.J. Churchfield, P.J. Moriarty, , S. Lee S. Li, J.K. Lundquist, J. Michalakes, A. Purkayastha, and M.A. Sprague. Computational modeling of turbine-wake effects. *SciDAC 2011, Denver, CO, 2011.*

Awarded SciDAC 2011 People's Choice Award

- K. Gruchalla, O. Desjardins, P. Pepiot, and A. Purkayastha. Numerical simulation of a turbulent liquid jet. *Super Computing 2010 (SC10)*, New Orleans, LA, 2010.
- K. Gruchalla, M.J. Churchfield, P.J. Moriarty, and L. Martinez. Eddy simulation of wind farm / atmospheric boundary layer interaction. *Super Computing 2010 (SC10)*, New Orleans, LA, 2010.
- K. Gruchalla, P. Pepiot, and O. Desjardins. Particle dynamics in a fluidized bed reactor. *SciDAC 2010, Chattanooga, TN, 2010.*

Awarded SciDAC 2010 Outstanding Achievement in Scientific Visualization

- K. Gruchalla and J. Marbach. Atmosv: Immersive visualization of the hurricane Isabel dataset. *IEEE Visualization 2004*, Austin, TX, 2004.

Awarded second place in the 2004 IEEE Visualization Contest

Thesis:

- K. Gruchalla. *Progressive Visualization-Driven Multivariate Feature Definition and Analysis*. PhD thesis, University of Colorado at Boulder, 2009.

- K. Gruchalla. *Immersive well-path planning: The added value of immersive visualization*. Master's thesis, University of Colorado at Boulder, 2003.
- Posters:**
- M. Dubin, A. Pardi, and K. Gruchalla. Using immersive virtual reality for visualization of macromolecules. Poster at *2004 Butcher Symposium on Genomics and Biotechnology*, 2004.
 - K. Gruchalla and J. Marbach. Atmosv: Immersive visualization of the Hurricane Isabel dataset. Contest Entry at *IEEE Visualization 2004*, Austin, TX, 2004.
Awarded second place in the 2004 IEEE Visualization Contest
- Non-refereed Papers:**
- G. Pech, K. Gruchalla, and J. Marbach. The case for visualization. *Exploration & Production*, January 2009.
 - K. Gruchalla and J. Marbach. Interactively exploring multiple characteristics of hurricane simulation data. *Advanced Imaging*, 22, 2005.
 - G. Dorn, K. Gruchalla, J. Carlson, J. Marbach, T. Southren, and A. Jamieson. A visualization-driven paradigm for adaptive well-path planning. In *Offshore Technology Conference*, 2004.

Honors and Awards

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| Research | <ul style="list-style-type: none"> • DOE SciDAC 2011 OASCR People's Choice Award • DOE SciDAC 2010 OASCR Outstanding Achievement in Scientific Visualization • Advanced Imaging Magazine 2005 Imaging Solutions of the Year • Second Place IEEE Visualization 2004 Visualization Contest |
| Industry (selected) | <ul style="list-style-type: none"> • Raytheon Space and Science Systems CHIP Award • Raytheon Bravo Award (\$1000) • Raytheon Systems Company Outstanding Achievement Award (\$500) • Hughes Space Systems Team Achievement Award (\$1000) |
| Academic | <ul style="list-style-type: none"> • New Mexico Tech Regents' Scholarship |

Presentations (selected)

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| Invited | <ul style="list-style-type: none"> • "Visual Analysis of Fluidized Bed Reactor Dynamics," DOE Computer Graphics Forum, Albuquerque, NM, April 2012. • "Visualization-Driven Multivariate Feature Analysis using Feature-Local Distributions," Colorado School of Mines, Joint Colloquia of AMS and EECS, Golden, CO, December 2011. • "Enabling Renewable Energy Research through Scientific Visualization," University of Colorado, Department of Computer Science Colloquium, Boulder, CO, March 2011. • "The Dawn of Scientific Visualization at NREL," <i>2010 DOE Computer Graphics Forum</i>, Park City, Utah, April 2010. • "Statistically Guided Multivariate Visualization and Analysis of Turbulence Structures," National Renewable Energy Laboratory (NREL), Golden, CO, April 2009. • "Interactive visualization and analysis of turbulence structures and their statistics," Laboratory of Computational Dynamics Turb-Helio Seminar. Boulder, Colorado, February 2009. • "Extending VAPOR's hardware-accelerated volume rendering capabilities," Computational and Information Systems Laboratory (CISL) Seminar, National Center for Atmospheric Research (NCAR). Boulder, Colorado, August 2007. • "Hardware-accelerated visualization of non-uniformly gridded volume data," <i>2007 DOE Computer Graphics Forum</i>, Peaceful Valley, Colorado, May 2007. • "Multivariate volume visualization," Laboratory of Computational Dynamics Turb-Helio Seminar. Boulder, Colorado, November 2005. |
| Contributed | <ul style="list-style-type: none"> • "Quantifying and Meshing Features in Microscopy Data," <i>2012 NREL High-Performance Computing Workshop</i>, Golden, CO, August, 2012 • "Segmentation and visualization of multivariate features using feature-local distributions," <i>International Symposium on Visual Computing 2011</i>, Las Vegas, NV, September, 2011 |

- “Visualization-Driven Structural and Statistical Analysis of Turbulent Flows,” *2009 Intelligent Data Analysis Conference*, Lyon, France, September 2009.
- “Immersive Examination of the Qualitative Structure of Biomolecules,” *2008 International Workshop on Qualitative Reasoning about Physical Systems*, Boulder, Colorado, June 2008.
- “Porting legacy applications to immersive virtual environments – a case study,” *The 2007 International Conference on Computer Graphics Theory and Applications*, Barcelona, Spain, March 2007.
- “Accounting network visualization,” 2005 Annual RiverWare User Group Meeting, Boulder, Colorado, March 2005.
- “Optimization and rules policy editor,” 2005 Annual RiverWare User Group Meeting, Boulder, Colorado, March 2005.
- “Workspace migration to Qt,” 2005 Annual RiverWare User Group Meeting, Boulder, Colorado, March 2005.
- “Immersive well-path editing: Investigating the added value of immersion,” *IEEE Virtual Reality 2004 Conference*, Chicago, Illinois, March 2004.
- “The COE Kansas City flood control method,” 2004 Annual RiverWare User Group Meeting, Boulder, Colorado, March 2004.
- “The added value of immersive visualization,” 2004 Drilling Visualization Research Consortium Meeting, Boulder, Colorado, January 2004.
- “Corps of Engineers flood control methods,” 2003 Annual RiverWare User Group Meeting, Boulder, Colorado, June 2003.
- “Plotting simulation data,” 2001 Annual RiverWare User Group Meeting, Boulder, Colorado, June 2001.

Expertise

Languages	C++, Python, R, Lisp, Fortran, IDL, OpenGL Shading Language, CUDA
Libraries	OpenGL, OpenInventor, VTK, ITK, Qt, NetCDF, MPI, X-Windows
Areas	Scientific visualization, immersive visualization, high-performance scientific computing, object-oriented development, numerical algorithm development, GUI, real-time programming, interactive computer graphics, and simulation

Professional Affiliations

Senior Member	IEEE, IEEE Computer Society
Member	IEEE Visualization and Graphics Technical Committee
Professional Member	Association for Computing Machinery (ACM)
Professional Member	ACM SIGGRAPH, ACM SIGCHI
Member	SIAM
Member	Sigma Xi
Professional Member	American Institute of Aeronautics and Astronautics (AIAA)

Service

Reviewing	IEEE Visualization 2004 - 2012, IEEE Infovis 2012, IEEE VAST 2012, SIGCHI 2012, EuroVis 2011, Journal of Information Science and Engineering, DOE ASCR 2009
Program Committee	Intelligent Data Analysis 2011-2012
Workshop Participation	DOE Exascale Workshop on Data Analysis, Management, and Visualization, 2011 NREL Workshop on Scientific Data Management and Informatics, 2009
Research	<i>Research Diver</i> , Pacific Whale Foundation, Summer 1998
Graduate	<i>Graduate Representative</i> , 2005-2006 Faculty Search Committee
Undergraduate	<i>Member</i> , 1993-1994 Solar Car Team <i>Senator</i> , 1991-1992 Student Senate <i>Member</i> , 1990-1991 Student Judiciary Board

Open-Source Development

VAPOR, (www.vapor.ucar.edu)

Role: Developer

Contributions: Volume rendering engines, transfer function interface, model parsing and rendering
An interactive 3D visualization and quantitative analysis software suite tailored towards terascale computational fluid dynamics data.

MarsFlight, (education.grc.nasa.gov/MarsFlight)

Role: Principal Engineer

Contributions: Terrain rendering, subsystems interface, map interface, and front-end configuration & deployment interface

An interactive flight simulator of a Mars airplane concept vehicle, which includes a complete model of the Martian terrain based on MOLA data and rover imagery. The flight simulator is based on the open source FlightGear (www.flightgear.org) project.

iPyMOL, (contact dubin@colorado.edu)

Role: Principal Engineer

Contributions: Immersive port

An immersive port of the PyMOL (pymol.sourceforge.net) molecular visualization system, adding interactive visualization support for head-tracked, stereoscopic immersive virtual environments.

Other

Certifications	Widerness EMT / EMT-B Open Water SCUBA Diver
Hobbies	Traditional rock climbing, mogul skiing, cycling, autonomous robotics
Development Portfolio	(available upon request)
Security Clearances	(available upon request)
References	(available upon request)