

Daniel Lakeland PhD.

Mathematical and Statistical Modeling

Interests

- Dynamic Modeling** The use of ordinary and partial differential equations, or Markov processes to describe the dynamics of physical, biological, economic, or other systems. Quantifying the uncertainty in parameters and system states.
- Economic and Decision Analysis** Comparing and quantifying the economic consequences of complex processes through time. Creating decision criteria for evaluating alternatives including uncertainty in outcomes. The pricing and evaluation of “real options” through monte-carlo state-space methods. Includes both business and personal financial decision making and investments.
- Bayesian Statistics** The use of MCMC methods to evaluate the posterior distribution of parameters in uncertain models of physical or economic processes. Use of Stan or JAGS modeling languages for simple models, and custom software for more complex models when necessary.

Education

- 2008–2013 **PhD Civil Engineering**, *University of Southern California*, Los Angeles, CA.
Mathematical Models of soil liquefaction, dissipative wave vibrations, and Bayesian statistical fitting of dynamical models
- 2003–2005 **BS Civil Engineering**, *UC Davis*, Davis, CA.
Emphasis on Mathematical Models of Fluid Flow, Economics of Sustainability, Soils, and Structures.
- 1993-1997 **BS Mathematics**, *Iowa State University*, Ames, IA.
Emphasis on mathematical modeling, numerical computation, optimization, probability and statistics. Minor in Computer Science

PhD Dissertation

- title *Continuum Modeling Techniques and Their Application to the Physics of Soil Liquefaction and Dissipative Vibrations*
- supervisors Roger Ghanem, Amy Rechenmacher

description Using continuum modeling techniques and asymptotic analysis, completely dispelled the myth that soil liquefaction occurs because of undrained fluid pressurization. Showed that pressure diffusion is equally important to fluid compression, and that permeability variation is critically important for the location of liquefaction onset. Published results in *Proceedings of the Royal Society A*. Showed that a new class of continuum models based on nonstandard analysis explained wave dissipation in microscopic fracture events, and used modern Bayesian statistical techniques to fit the dynamical model of wave dissipation to detailed information available from molecular dynamics simulations.

Experience

- 2013–present **Owner and Analyst**, *Lakeland Applied Sciences LLC*, Altadena, CA.
Consulting on the development of mathematical and statistical models for physical and bio sciences, engineering, and business. Projects include design of engineering damage surveys and economic damage assessments, computational agent based models of cell division, and growth of bones (publication in submission), Bayesian models of biological expression data, spatial and temporal quantitative models of Economic conditions, and models of Alcohol use and abuse from public surveys.
- 2009 **Independent Consultant**, *Oregon Health Sciences University*, Portland, OR.
Built dynamic model of response of fruit fly maggots to hypoxic atmospheric conditions. Predicted the histograms of observed time-to-escape events from ordinary differential equations with biologically relevant parameters. Developed Bayesian fitting techniques for evaluating the effect of various treatments on the histogram of observed times
- 2006–2008 **Forensic Analyst**, *Jax Kneppers Associates*, Walnut Creek, CA.
Provided forensic expertise to evaluating the cause and extent of damages caused by building flaws, design flaws, project management failures, and contract disputes. Included field evaluations and statistical sampling and analysis.
Detailed achievements:
- Developed mathematical model of fluid flow in small channels behind installed siding products, including the effect of wetting resistance and capillary action to quantify the parameters that affected the migration of water throughout the wall.
 - Built and fit a model of the dynamics of capillary rise and evaporation of water in wall assemblies containing exterior type gypsum wall board to quantify the height to which water damages would be expected when exposed to variable rainfall and standing water.
 - Discovered the source of disputed excess loads of earth movement in site preparation: caused by errors in mathematical estimation of loading.
 - Planned and carried out statistical random sampling to quantify the quantity of fencing installed in a large development project, and the variation in fence durability across the site.
 - Planned and carried out statistical random sampling protocols to quantify extent of roofing flaws in luxury home construction in Hawaii.
- 2005–2006 **Independent Consultant**, *Oregon Health Sciences University*, Portland, OR.
Developed mathematical technique for predicting the target genes for transcription factors by filtering the scored binding affinity along each chromosome using signal processing techniques. Published results in journal *Bioinformatics*

- 2004 **Independent Consultant**, *Archetype Solutions Inc*, Berkeley, CA.
 Provided data analysis and mathematical modeling for clothing manufacturing industry through custom clothing technology company.
 Specific Achievements:
 - Using SQL database of optical body scan measurements modeled the covariation of critical body measurements for men's pants. Discovered optimal scaling of pants sizes to maximize the number and type of people who could fit a given brand's offerings.
 - Taught R based data analysis software to analysis team.
 - Analyzed sales demographics for a major women's Lingerie manufacturer.
- 2000-2003 **Owner**, *Endpoint Computing*, Lafayette, CA.
 Provided software development expertise and consulting
- 2000 **Software Developer**, *Neomorphic Inc.*, Berkeley, CA.
 Developed software for analysis of bioinformatics data. Company was sold to Affymetrix shortly after I joined.
- 1998-2000 **Research Analyst: Special Projects**, *Barra Inc.*, Berkeley, CA.
 Provided software development and statistical analysis expertise to financial risk analysis projects. Including quality control of ticker feed data, models for the effect of news stories of various types on the short term price-risk of stocks. Quality metrics for Market Impact Model which estimates the effect of trade demand on short term price movements.
- 1997-1998 **Security Software Developer**, *Mondex USA*, San Francisco, CA.
 Developed custom software for the secure collection of risk management data from banks and card-processing companies using specialized smartcard payment technology. Software used standardized algorithms such as Blowfish encryption and RSA public key encryption and authentication using the Python computer language.

Computer skills

Statistics	BUGS/JAGS, Stan, R	Databases	MySQL, SQLite, PostgreSQL
Languages	R, Python, Perl, Common Lisp Prolog, C/C++ ...	Mathematics	Maxima computer algebra system
Scripting	bash shell, UNIX utilities	Mechanics	LAMMPS

Publications

Dennis J. Hazelett, Jer-Cherng Chang, Daniel L. Lakeland, and David B. Morton. Comparison of parallel high-throughput RNA sequencing between knockout of TDP-43 and its overexpression reveals primarily nonreciprocal and nonoverlapping gene expression changes in the central nervous system of *Drosophila*. *G3 (Bethesda, Md.)*, 2(7):789–802, July 2012.

Dennis J. Hazelett, Daniel L. Lakeland, and Joseph B. Weiss. Affinity Density: a novel genomic approach to the identification of transcription factor regulatory targets. *Bioinformatics (Oxford, England)*, 25(13):1617–1624, July 2009.

Dennis J. Hazelett, Suhn Kyong Rhie, Malaina Gaddis, Chunli Yan, Daniel L. Lakeland, Simon G. Coetzee, Ellipse/GAME-ON consortium, Practical consortium, Brian E.

Henderson, Houtan Noushmehr, Wendy Cozen, Zsofia Kote-Jarai, Rosalind A. Eeles, Douglas F. Easton, Christopher A. Haiman, Wange Lu, Peggy J. Farnham, and Gerhard A. Coetzee. Comprehensive functional annotation of 77 prostate cancer risk loci. *PLoS genetics*, 10(1):e1004102, January 2014.

D. L. Lakeland, A. Rechenmacher, and R. Ghanem. Towards a complete model of soil liquefaction: the importance of fluid flow and grain motion. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 470(2165):20130453–20130453, February 2014.

In Kyoung Mah, Rachel Soloff, Audrey K. Izuhara, Daniel L. Lakeland, Charles Wang, and Francesca V. Mariani. Prkci is required for a non-autonomous signal that coordinates cell polarity during cavitation. *Developmental Biology*, 416(1):82–97, August 2016.

Marissa K. Srour, Jennifer L. Fogel, Kent T. Yamaguchi, Aaron P. Montgomery, Audrey K. Izuhara, Aaron L. Misakian, Stephanie Lam, Daniel L. Lakeland, Mark M. Urata, Janice S. Lee, and Francesca V. Mariani. Natural large-scale regeneration of rib cartilage in a mouse model. *Journal of Bone and Mineral Research: The Official Journal of the American Society for Bone and Mineral Research*, 30(2):297–308, February 2015.