Joshua R. Davis

Education

University of Wisconsin	Madison, WI	Mathematics	Ph.D. 2005
Oberlin College	Oberlin, OH	Mathematics, Computer Science	B.A. 1998

Appointments

Lecturer 2017–present
Carleton College

Research Associate 2011–2015
University of Wisconsin-Madison

Visiting Assistant Professor, Research Associate (sporadically) 2007–2017
Carleton College

Teaching Assistant Professor, Lecturing Fellow 2005–2007
Duke University

Teaching Assistant 2000–2004
University of Wisconsin-Madison

Publications

Titus, S.J. and Davis, J.R. *Problems with net tectonic rotation for dikes and suggestions for alternative approaches.* Geochemistry, Geophysics, Geosystems, 122 (2021).

Garibaldi, N., Tikoff, B., Peterson, D., Davis, J.R., and Keranen, K. *Statistical separation of tectonic and resurgence-driven components of deformation on silicic reservoirs, Laguna del Maule volcanic field, Chile.* Journal of Volcanology and Geothermal Research, 389 (2020).

Williams, R.T., Davis, J.R., and Goodwin, L.B. *Do large earthquakes occur at regular intervals through time? A perspective from the geologic record.* Geophysical Research Letters, 46 (2019) 8074-8081.

Roberts, N., Tikoff, B., Davis, J.R., and Stetson-Lee, T. *The utility of statistical analysis in structural geology.* Journal of Structural Geology, 125 (2019) 64–73.

Titus, S.J., Chapman, W., Horst, A.J., Brown, M., and Davis, J.R. *Distributed deformation in an oceanic transform system: Applying statistical tools to structural and paleomagnetic data near the Húsavík-Flatey fault, northern Iceland.* Tectonics, 37 (2018) 3986–4017.

Bilardello, D., Callebert, W., and Davis, J.R. *Evidence for widespread remagnetizations in South America, case study of the Itararé Group rocks from the state of São Paulo, Brazil.* Frontiers in Earth Science, 6 (2018).

Davis, J.R., and Titus, S.J. *Review article: Modern methods of analysis for three-dimensional orientational data.* Journal of Structural Geology, 96 (2017) 65-89.

Titus, W.J., Titus, S.J., and Davis, J.R., *A Bayesian approach to modeling 2D gravity data using polygons.* Geophysics, 82 (2017) G1-G21.

Michels, Z.D., Kruckenberg, S.C., Davis, J.R., and Tikoff, B. *Determining vorticity axes from grain-scale dispersion of crystallographic orientations.* Geology, 43 (2015) 803-806.

Davis, J.R. and Giorgis, S. *An inverse approach to constraining strain and vorticity using rigid clast shape preferred orientation data.* Journal of Structural Geology, 68 (2014) 337-346.

Davis, J.R., Titus, S.J., and Horsman, E. *Non-steady homogeneous deformations: Computational techniques using Lie theory, and application to ellipsoidal markers in naturally deformed rocks.* Journal of Structural Geology, 56 (2013) 142-155.

Scott, C.P., Titus, S.J., and Davis, J.R. *Using field data to constrain a numerical kinematic model for ridge-transform deformation in the Troodos ophiolite, Cyprus.* Lithosphere, 5 (2013) 109-127.

Davis, J.R. and Titus, S.J. *Homogeneous steady deformation: A review of computational techniques.* Journal of Structural Geology, 33 (2011) 1046-1062.

Davis, J.R., Liben-Nowell, D., Sharp, A. and Wexler, T. *Mediated equilibria in load-balancing games.* Chicago Journal of Theoretical Computer Science, 5 (2011).

Davis, J.R., Goldman, Z., Hilty, J., Koch, E.N., Liben-Nowell, D., Sharp, A., Wexler, T., and Zhou, E. *Equilibria and Efficiency Loss in Games on Networks.* Internet Mathematics, 7 (2011) 178-205.

Davis, J.R. *Degenerate Relative Gromov-Witten Invariants and Symplectic Sums.* Ph.D. thesis, University of Wisconsin-Madison (2005).

Awards, Grants, and Fellowships

Consultant on National Science Foundation (NSF) grant *Broadening community use and adoption of StraboSpot* with principal investigator Basil Tikoff of University of Wisconsin–Madison Geoscience (2019–present)

Consultant on NSF grant *Linking slip dynamics to off-fault deformation in strike-slip fault systems* with principal investigators Jacqueline Reber of Iowa State University Geology and Sarah J. Titus of Carleton College Geology (2019–present)

Consultant on NSF grant *A unified experimental-natural digital data system for analysis of rock microstructures* with principal investigator Matty Mookerjee of Sonoma State University Geology (2017–present)

Consultant on NSF grant *Combining field data and computational models to characterize the distribution of cceanic transform fault deformation throughout the lithosphere* with principal investigator Titus (2012–2020)

Consultant on NSF grant *Differential geometry and statistics of deformation tensors* with principal investigators Tikoff and Titus (2011–2015)

Mathematical Association of America Project NExT Fellowship (2006–2007)

Excellence in Teaching Award, UW-Madison Mathematics Department (2002)

NSF VIGRE Fellowship (2002)

French-Felten Award, UW-Madison College of Letters and Science (2001)

Prize University Fellowship, UW-Madison (1998–2000)

Hughes Foundation grant, Oberlin College (1998)

Orr Memorial Prize, Oberlin College (1998)

Miscellany

For several years I have published software and open-source code libraries (C, R, Mathematica) for geological computations. See `http://www.joshuadavis.us/software.html`.

With Sarah J. Titus (Carleton College Geology) and Basil Tikoff (University of Wisconsin Geoscience) I have run a one-day short course about geometric statistics for geology data analysis — once at the Structural Geology and Tectonics Forum, 2018 and once at the GSA fall meeting, 2015. During spring 2015 I ran a weekly research seminar for Tikoff's graduate students and postdocs.

I am developing a field course as part of a team led by Rick Allmendinger (Cornell University, emeritus). I am contributing to a textbook as part of a team led by Vince Cronin (Baylor University). Occasionally I referee articles, primarily for the Journal of Structural Geology.

I have served on committees for several of Tikoff's graduate students: Nicolas M. Roberts (Ph.D. 2020), Nicolas Garibaldi (Ph.D. 2019), Zachary D. Michels (Ph.D. 2016), Tor Stetson-Lee (M.S. 2015). I am currently on the Ph.D. committee of Emily Ross, who is a student of Jacqueline Reber at Iowa State University.

At Carleton College I have supervised three mathematics comps projects: Sam Bacon (2017), Joseph Pedtke, Samir Rachid Zaim, Alex Rusciano, John Stromme (2014), and Kyle Drake, Michael Feinberg, David Guild, Emma Turetsky (2009). Recently I have served on the independent comps committees of Nathaniel Sauerberg, Tyler Chang (2020), Noah Goldman, and Charlie Kapsiak (2019).

I assisted Helen Wong in advising her 2017 mathematics comps group. I frequently assist Sarah J. Titus in advising her geology comps students: Natalie Hummel, Kate Nootenboom, Elizabeth Zhu, Matt Carter, Grace Pipes, Miranda Wiebe, Seth Waag-Swift, Max Longchamp, Sarah Alexander, Chelsea Wagner, Mariah Radue, Chelsea P. Scott.

I have supervised independent readings/studies, recently including Ross Grogan-Kaylor, Elliot Pickens, Zhihan Yang, and Sonia Moreno (2019).

Talks and Posters

Mookerjee, M. and Davis, J.R. *Parameters affecting the accuracy of inverse models of quartz crystallographic preferred orientation.* EarthCube Annual Meeting, 2020.

Hummel, N., Titus, S.J., Waag-Swift, S., Davis, J.R., Ashwell, P., and Brown, M. *Characterizing deformation surrounding the Husavik-Flatey fault in northern Iceland using statistical analysis of structural and paleomagnetic data.* AGU fall meeting, 2019.

Davis, J.R. and Mookerjee, M. *Forward and inverse modeling of the development of quartz crystallographic preferred orientation textures in shear zones.* AGU fall meeting, 2019.

Davis, J.R., Titus, S.J., and Chatzaras, V. *Dynamic Models of Ellipsoidal Data from Shear Zones.* AGU fall meeting, 2018.

Titus, S.J., Waag-Swift, S., Hummel, N., and Davis, J.R. *Deformation in Wide Transform Systems: An Example from Northern Iceland.* AGU fall meeting, 2018.

Garibaldi, N., Tikoff, B., Davis, J.R., Peterson, D., Keranen, K., and Singer, B. *Tectonic controls on crustal deformation caused by magmatic injection: The active Laguna del Maule volcanic field, Chile.* Chilean Geology Conference, 2018.

Cronin, V.S., Gordon, R.G., Resor, P.G., and Davis, J.R. *A half-century after the revolution, what should we teach current undergraduate geoscientists about lithospheric motion?* 50 Years of Plate Tectonics Symposium, 2018.

Titus, S.J., Wagner, C., Chapman, W., and Davis, J.R.. *Quantifying distributed deformation near oceanic transform faults: Examples from Cyprus and Iceland.* Structural Geology and Tectonics Forum, 2018.

Waag-Swift, S., Titus, S.J., and Davis, J.R.. *Using small-scale structures to constrain distributed deformation near the Husavik-Flatey fault, northern Iceland.* Structural Geology and Tectonics Forum, 2018.

Davis, J.R., Titus, S.J., and Chatzaras, V. *How do geologic data constrain shear zone models, really?* Structural Geology and Tectonics Forum, 2018.

Davis, J.R., Chatzaras, V., Roberts, N.M., Poppick, A., and Titus, S.J. *Statistics of ellipsoidal data from ridge-transform systems.* GSA fall meeting, 2017.

Bacon, A.T., Davis, J.R., and Titus, S.J. *Using maximum-likelihood estimates and Bayesian statistics to study shear zones and ridge-transform systems.* GSA fall meeting, 2017.

Siegel, H., Judge, S., and Davis, J.R. *Visual and quantitative comparison of structural data from the Wasatch monocline (central Utah) using two computer programs: Stereonet and*

R. GSA fall meeting, 2016.

Davis, J.R. and Titus, S. *Bayesian Markov chain Monte Carlo methods for modeling rock deformation.* Structural Geology and Tectonics Forum, 2016.

Titus, S., Wagner, C., Alexander, S., and Davis, J.R. *Quantifying Deformation in Ridge-Transform Systems: An Example from the Troodos Ophiolite, Cyprus.* Structural Geology and Tectonics Forum, 2016.

Davis, J.R., Titus, S., Giorgis, S.D., and Horsman, E.M. *Markov Chain Monte Carlo simulation to assess uncertainty in models of naturally deformed rock.* AGU fall meeting, 2015.

Titus, W.J., Titus, S., and Davis, J.R. *A Bayesian approach to modeling 2D gravity data using polygon states.* AGU fall meeting, 2015.

Michels, Z.D., Kruckenberg, S.C., Davis, J.R., and Tikoff, B. *Determining grain-scale vorticity axes from crystallographic orientation data.* AGU fall meeting, 2015.

Roberts, N., Davis, J.R., Titus, S., and Tikoff, B. *Harnessing multivariate statistics for ellipsoidal data in structural geology.* AGU fall meeting, 2015.

Titus, S., Wagner, C., Alexander, S.O., Scott, C.P., Davis, J.R. *Styles of deformation on either side of a ridge-transform intersection, Troodos ophiolite, Cyprus.* AGU fall meeting, 2015.

Davis, J.R., Chatzaras, V., Michels, Z., Titus, S.J., and Tikoff, B. *Modern statistical methods for analyzing 3D geologic data.* DRT, 2015. Published in Geotectonic Research, 97 (2015) 10-11.

Michels, Z.D., Kruckenberg, S.C., Davis, J.R., and Tikoff, B. *A new approach for determination of vorticity axes from orientation maps.* DRT, 2015. Published in Geotectonic Research, 97 (2015) 62-63.

Titus, S.J., Wagner, C.A., Alexander, S.O., Scott, S.C., and Davis, J.R. *Comparing deformation from the inside and outside corners of a ridge-transform system using field and rock magnetic data, Troodos ophiolite, Cyprus.* DRT, 2015. Published in Geotectonic Research, 97 (2015) 85-87.

Davis, J.R., Titus, S., and Tikoff, B. *Rotation statistics for geologic data.* GSA fall meeting, 2014.

Davis, J.R., Titus, S., and Tikoff, B. *Rotation statistics in structural geology.* Structural Geology and Tectonics Forum, 2014.

Tikoff, B., Davis, J., and Titus, S. *Possible future directions for understanding transpressional deformation and oblique tectonics.* EGU spring meeting, 2014.

Davis, J.R., and Titus, S.J. *Modeling deformation across a paleotransform fault in the New*

Caledonia ophiolite using shape preferred orientation of orthopyroxene grains. GSA fall meeting, 2013.

Giorgis, S. and Davis, J.R. *An inverse approach to extracting strain and vorticity data from porphyroclast populations.* GSA, 2012.

Horsman, E., Davis, J.R. and Titus, S.J. *Using deformable clasts to constrain rock deformation: An example from the Gem Lake shear zone.* GSA, 2012.

Davis, J.R., Giorgis, S., and Titus, S.J. *Computation of homogeneous deformations, and application to the western Idaho shear zone, USA*. Structural Geology and Tectonics Forum, 2012.

Scott, C., Titus, S.J., and Davis, J.R. *A numerical kinematic model for deformation near a ridge-transform intersection in the Troodos ophiolite, Cyprus based on gabbro paleomagnetic rotations and sheeted dike orientations.* AGU fall meeting, 2011.

Davis, J.R. and Titus, S.J. *Deformable and rigid ellipsoids in viscous flows: Computational methods.* GSA, 2011.

Titus, S.J. and Davis, J.R. *A unified computational approach for models of homogeneous steady deformation.* Penrose Conference on Deformation Localization, Spain, 2011.

Scott, C., Titus, S.J., and Davis, J.R. *Kinematic modeling of deformation near a ridge-transform intersection in the Troodos Ophiolite, Cyprus.* AGU fall meeting, 2010.

Titus, S.J. and Davis, J.R. *Modeling the evolution of a transform fault in the mantle section of the New Caledonia ophiolite.* AGU fall meeting, 2010.

Titus, S.J. and Davis, J.R. *Modeling the evolution of a transform fault in the mantle section of the New Caledonia ophiolite.* GeoNZ meeting, Auckland, New Zealand, 2010.

Titus, S.J. and Davis, J.R., *New advances in strain modeling: Steady-state deformation using matrix exponentials and matrix logarithms.* Structural Geology and Tectonics Forum, Madison, WI, 2010.

Titus, S.J. and Davis, J.R. *Steady-state deformation using matrix exponentials.* AGU fall meeting, 2009.

Titus, S.J., Davis, J.R., Ferre, E., and Tikoff, B. *Quantifying Strain Across a Paleotransform Fault in the Mantle Section of an Ophiolite, New Caledonia.* AGU fall meeting, 2008.

Titus, S.J., Davis, J.R., Ferre, E., and Tikoff, B. *Quantifying strain across a paleotransform fault using incremental models of deformation, Bogota Peninsula, New Caledonia.* GSA fall meeting, 2008.

Davis, J.R. *Singular relative Gromov-Witten invariants.* St. Olaf College Mathematics Department, 2008.

Davis, J.R. *Singular relative Gromov-Witten invariants.* Carleton College Mathematics Department, 2007.

Davis, J.R. *Singular relative Gromov-Witten invariants.* Special Session on Floer Homology, Joint Mathematics Meetings, 2007.

Davis, J.R. *Singular relative Gromov-Witten invariants.* Brown University Mathematics Department, 2006.