Name: **Eric Olson**

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University of Nevada, Reno
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Education:

Ph.D., Mathematics, August 1999
Indiana University, Bloomington
Advisor: Ciprian Foias

M.S., Statistics, August 1995
Indiana University, Bloomington

M.S., Mathematics, August 1991
The Ohio State University, Columbus

B.S., Math and Physics, August 1988
The Ohio State University, Columbus

Professional Positions Held:

2008–*present*	University of Nevada, Reno, Department of Mathematics Associate Professor
2013–2014	University of Warwick, Mathematics Institute Visiting Associate Professor
2003–2004	Indiana University, Department of Mathematics Visiting Assistant Professor
2000–2008	University of Nevada, Reno, Department of Mathematics Assistant Professor
1999–2002	University of California, Irvine, Department of Mathematics NSF Postdoctoral Research Fellow

Awards and Grants:

Westfall Scholar Mentor selected by James Clifford, May 2018.

UNR Undergraduate Research Award ($1800) with James Clifford, November 2017
Approximate Set Differences and Point Clouds.

NSF grant DMS-1418928 ($120,000), September 2014
Determining Forms and Data Assimilation with Stochastic Data.

Collaborator on EPSRC grant by James Robinson (£21,935), September 2013
Additional support while on sabbatical at University of Warwick.

UNR Sabatical Leave ($42,000), September 2013

Westfall Scholar Mentor selected by Ruslana Dalinina, November 2009.

PC-Doctor ($10,000), September 2008
Detecting CPU, FPU and Memory Subsystem Errors by Means of Deterministic Chaos.

Nevada NSF EPSCoR ACES ($58,000) with Satoko Kurita, January 2004
In-situ Bioremediation of Contaminated Soil.

UNR Junior Faculty Research Award ($15,000), August 2002
Determining Modes in the LANS-Alpha Model.

NSF Postdoctoral Fellowship ($68,000) with Edriss Titi, January 1999
Averaged Lagrangians, Camassa-Holm Equations and Turbulence

IU Mathematics Department Fellowship ($1200), August 1997

Nominated for GAANN Fellowship, August 1997

The IU Mentoring Program, August 1996

David A. Rothrock Teaching Award ($100), April 1994

Graduate and Undergraduate Students Supervised:

Chris Wingard, *In progress*
Ph.D. Thesis: *An Approximate Inertial Manifold for the Kuramoto–Sivashinsky Equation*

Beau Smith, *2023*
Ph.D. Thesis: *On the Solvability of Inverse Problems Arising from the Two-layer Lorenz 96 System.*

Darsh Patel, 2021
Davidson Academy Student: *Scientific Visualization of the Complex Basin of Attraction for a Cubically Convergent Root-finding Scheme.*

Hongquan Li, 2019
Undergraduate Honors Thesis: *The Order of Convergence of a Secant-like Iterative Scheme for Finding Zeros of Higher Multiplicity.*

James Clifford, 2018
Undergraduate Honors Thesis: *Use of Approximate Set Differences to Infer the Movement of Objects in Point Clouds.*

Beau Smith, 2017
Masters Thesis: *Symmetry-breaking Perturbations on the Global Attactor of the Kuramoto–Sivashinsky Equation.*

Jordan Blocher, 2016
Masters Thesis: *Time Averaged Measurements in Data Assimilation.*

Masakazu Gesho, 2013
Masters Thesis: *A Numerical Study of Continuous Data Assimilation for the 2D Navier–Stokes Equations Using Nodal Points.*

Xander Henderson, 2013
Masters Thesis: *Assouad Dimension and the Open Set Condition.*

Chris Wingard, 2009
Masters Thesis: *Exact Filtering of Measurement Errors in Dynamical Systems.*

Kevin Hayden, 2007
Masters Thesis: *Discrete in Time Coupling and Synchronization of the Lorenz System.*

Refereed Publications:

1. Data Assimilation using Time-Delay Nudging in the Presence of Gaussian Noise (with Emine Celik), Journal of Nonlinear Science, Vol 33, Article 110, 2023, 31 pages.
2. The Computation of Wandering Points on the Global Attractor by Means of Symmetry-breaking Perturbations (with Alexey Cheskidov and Beau Smith), Pure and Applied Functional Analysis, Vol 7, No 1, 2022, pp 145–173.
3. Energy and Enstrophy Study of the Time-Relaxation Model (with Tahj Hill, Monika Neda and Fran Pahlevani), International Journal of Numerical Analysis and Modeling, Vol 18, No 2, 2021, pp. 165–189.
4. Stochastic Parameterization of the Time-Relaxation Model of Turbulence, Results in Applied Mathematics, Vol 8, 2020, 17 pages.
5. Continuous Data Assimilation with Blurred-in-time Measurements of the Surface Quasi-geostrophic Equation (with Mike Jolly, Vincent Martinez and Edriss Titi), Chin. Ann. Math. Ser. B, Vol. 40, No. 2, 2019, pp. 721–764.
6. Spectral Filtering of Interpolant Observables for Discrete-in-time Data Assimilation (with Emine Celik and Edriss Titi), SIAM Journal on Applied Dynamical Systems, Vol. 18, No. 2, 2019, pp. 1118–1142.
7. Stochastic model error in the LANS-alpha and NS-alpha deconvolution models of turbulence, International Journal of Numerical Analysis and Modeling, No. 6, 2018, pp. 811–833.
8. Continuity of Pullback and Uniform Attractors (with Luan Hoang and James Robinson), Journal of Differential Equations, Vol 264, Issue 6, 15 March 2018, pp. 4067–4093.
9. Data Assimilation Using Noisy Time-Averaged Measurements (with Jordan Blocher and Vincent Martinez), Physica D, Volumes 376–377, August 2018, pp. 49–59.
10. Some Results in Support of the Kakeya Conjecture (with Jonathan Fraser and James Robinson), Real Analysis Exchange, Vol. 42, No. 2, 2017, pp. 253–268.
11. Lower bounds on blowing-up solutions of the 3D Navier-Stokes equations in $H^{3/2}$, $H^{5/2}$ and $B^{2,15/2}$ (with David McCormick, James Robinson, Jose Rodrigo, Vidal-Lopez and Yi Zhou) SIAM Journal on Mathematical Analysis, Vol. 48, No. 3, 2016, pp. 2119–2132.
12. A Computational Study of a Data Assimilation Algorithm for the Two-dimensional Navier–Stokes Equations (with Masakazu Gesho and Edriss Titi), Communications in Computational Physics, Volume 19, no. 4, 2016, pp. 1094–1110.
13. A Simple Example Concerning the Upper Box-counting Dimension of a Cartesian Product (with James Robinson), Real Analysis Exchange, Volume 40.2, 2016, pp. 449–452.
14. Generalised Cantor Sets and the Dimension of Products (with James Robinson and Nicholas Sharples), Mathematical Proceedings of the Cambridge Philosophical Society, Volume 160, 2016, no. 1, pp. 51–75.

15. On the Continuity of Global Attractors (with Luan Hoang and James Robinson), Proceedings of the American Mathematical Society, Volume 143, 2015, no. 10, pp. 4389–4395.
16. On the Assouad Dimension of Self-similar Sets with Overlaps (with Jonathan Fraser, Alexander Henderson and James Robinson), Advances in Mathematics, Volume 273, 2015, pp. 181–214.
17. Continuous Data Assimilation with Stochastically Noisy Data (with Hakima Bessaih and Edriss Titi), *Nonlinearity*, **28** (2015), 729–753.
18. Continuous Data Assimilation Using General Interpolant Observables (with A. Azouani and E.S. Titi), *Nonlinear Science*, **24** (2014), 277–304.
19. Discrete data assimilation in the Lorenz and 2D Navier–Stokes equations (with K. Hayden and E.S. Titi), *Phys. D*, **240**:18 (2011), 1416–1425.
20. Almost Bi-Lipschitz Embeddings and Almost Homogeneous Sets, (with James Robinson), *Trans. Amer. Math. Soc.*, **362**:1 (2010), 145–168.
21. The Normal Form of the Navier–Stokes Equations in Suitable Normed Spaces (with Ciprian Foias, Luan Hoang and Mohammed Ziane), *Ann. Inst. H. Poincar Anal. Non Linéaire*, Vol. 26, No. 5, 2009, pp. 1635–1673.
22. Determining Modes and Grashof Number in 2D Turbulence–A Numerical Case Study (with Edriss Titi), *Theoretical and Computational Fluid Dynamics*, Vol. 22, No. 5, 2008, pp. 327–399.
23. Viscosity Versus Vorticity Stretching: Global Well-posedness for a Family of Navier–Stokes-Alpha-like Models (with Edriss Titi), *Nonlinear Anal.*, Vol. 66, No. 11, 2007, pp. 2427–2458.
24. On the Solutions to the Normal Form of the Navier–Stokes Equations (with Ciprian Foias, Luan Hoang and Mohammed Ziane), *Indiana Univ. Math. J.*, Vol. 55, No. 2, 2006, 631–686.
25. On a Leray-alpha Model of Turbulence (with Alexey Cheskidov and Edriss Titi), *Proc. R. Soc. Lond. Ser. A Math. Phys. Eng. Sci.*, Vol. 461, No. 2055, 2005, pp. 629–649.
26. Determining Modes for Continuous Data Assimilation in 2D Turbulence (with Edriss Titi), *J. Stat. Phys.*, Vol. 133, No. 5/6, December 2003, pp. 799–839.
27. Bouligand Dimension and Projections with Almost Lipschitz Inverse, *Pacific J. Math.*, Vol. 202, No. 2, 2002, pp. 459–474.
28. A Connection Between the Camassa–Holm Equations and Turbulent Flows in Channels and Pipes (with Shiyi Chen, Ciprian Foias, Darryl D Holm, Edriss S Titi, and Shannon Wynne), *Phys. Fluids*, **11**:8 (1999), 2343–353.
29. The Camassa–Holm Equations and Turbulence (with Shiyi Chen, Ciprian Foias, Darryl D Holm, Edriss S Titi, and Shannon Wynne), *Phys. D*, Vol. 133, No. 1-4, 10 Sept. 1999, pp. 49–65.
30. The Camassa–Holm Equations as a Closure Model for Turbulent Channel Flow (with Shiyi Chen, C. Foias, D.D. Holm, E.S. Titi, and S. Wynne), *Phys. Rev. Lett.*, **81**:24 (1998), 5338–5341.

31. Finite Fractal Dimension and Hölder–Lipschitz Parametrization (with C. Foias), *Indiana Univ. Math. J.*, **45**:3 (1996), 603–616.

U.S. Patents:

32. Detecting CPU, FPU and Memory Subsystem Errors by Means of Deterministic Chaos, No. 12/657025, September 22, 2011.

Other Creative Work:

33. The Orthogonal Projection of Fractal Sets, UMI, Ph.D. Dissertation, Indiana University, 1999, 57 pages.
34. A Simple Example of a Continuous Function that is Nowhere Differentiable, *Classics on Fractals*, Edited by Gerald A Edgar, Addison-Wesley, 1993 (translation of Karl Kiesswetter, Ein einfaches Beispiel für eine Funktion welche überall stetig und nicht differenzierbar ist, Math.-Phys. Semesterber, **13** (1966), 216–221).

Publications in Progress:

35. On the Assouad dimensionof differences of self-similar fractals (with Alexandros Margaris and James Robinson), *under revision.*

Publications in Preparation:

The use of Derivative Information to Determine the State of the Sabra Shell Model (with Emine Celik), in preparation.

A Moran Open-Set condition for Non-autonomous Iterated Function Systems, (with Xander Henderson, James Robinson and Nicholas Sharples), in preparation.

Software Development:

`t1sim`, Perform discrete-in-time data assimilation experiments using general type-1 interpolant observables with stochastic noise, Written in C99 for execution on parallel clusters using MPI. January 2019 version consists of 1722 lines of code written by Olson.

`gpudiff`, Use the new $\mathcal{O}\big(n(\log n)^2\big)$ gridless recursive-boxing algorithm to compute approximate set differences based on the Hausdorff metric. Designed for parallel execution on CUDA GPU hardware. A version for SMP CPUs was also written. April 2018 version consists of 3777 lines of code written by Clifford and Olson.

`lans`, Compute time evolution of residuals for LANS-α and LANS-α deconvolution models of turbulence. Written for execution on multi-core SMP hardware using the Intel/MIT Cilk parallel extentions to the C99 programming language. March 2015 version consists of 981 lines of code written by Olson.

`cilkrts`, Port of the runtime library for the MIT/Intel Cilk parallel programming extensions of the gcc-5.1 compiler to the ARMv7-A architecture used in the Raspberry Pi 2B computer. Changes from March 2015 consisted of 261 lines of code.

`pcc`, Contribution of unicode support for Anders Magnusson's continued development of the original Bell Labs Portable C Compiler. Changes consisted of about 300 lines of C code. The May 5, 2014 document

`http://pcc.ludd.ltu.se/documentation/`

by Olson describes the changes.

`gpunav`, Perform continuous data assimilation experiments using nodal measurements of velocity, vorticity or stream functions for the 2DNS. Designed for parallel execution on CUDA GPU hardware with optimized control flow for GPU and zero memory copies between host and device memory per time step. May 2013 version consists of 2810 lines of C and CUDA code written by Gesho and Olson.

`ns2d`, Perform continuous data assimilation experiments using Fourier mode coupling for the two-dimensional incompressible Navier–Stokes equations and α models of turbulence. Designed for parallel computation of multiple approximating solutions u_j for parameter studies using OpenMPI and FFTW. August 2010 version consists of 8689 lines of C code written by Olson.

Teaching Experience:

Undergraduate Courses

Honors Calculus I and II (10 semesters)
Undergraduate Analysis I and II (5 semesters)
Linear Algebra (6 semesters)

Ordinary Differential Equations (5 semesters)
Calculus I and II (3 semesters)
Business Calculus (3 semesters)
Mathematics for Elementary School Teachers (1 semester)

Combined Graduate/Undergraduate Courses
Partial Differential Equations (2 semester)
Numerical Methods I and II (8 semesters)
Advanced Linear Algebra (1 semester)

Graduate Courses
Fourier, Wavelet and Complex Variable Methods
in Applied Mathematics I and II (2 semesters)
Real Variables I and II (2 semesters)
Partial Differential Equations I and II (2 semesters)
Numercial Analysis I and II (2 semesters)
Complex Variables (1 semester)

Independent Study and Overload
Real Analysis (Paige DePolo 2015)
Complex Variables (Masakazu Gesho, Dol Nath and Yibo Xu 2012)
Fourier Analysis (Cyrus Luciano 2010)
Wavelet and Applications (Ruslana Dalinina 2008)
Complex Variables (Suresh Kumar 2005)

Department and University Service:

Department
Computing Committee (2000–2003 and 2006–current)
Applied Mathematics Website (2005–current)
Hiring Committee (2002 and 2007)
Thesis Committees (12 students)
Qualifying Exams (5 exams)
Beowulf Cluster (2001–2011)
Future of Applied Mathematics (2005–2006)
Open House Committee (2004)
Merit Committee (2001)
Graduate Committee (2000)

College
Curriculum Committe (2005–2009)
Working Group on Computational Sciences (2010)

Research and Teaching Related Service:

Outside Advisor for Ph.D. Thesis
Alexandros Margaris (2019)

Consultant for PC Doctor
Computer Memory Subsystem Reliability Testing (2007–2009)

Outside Ph.D. Examiner for University of Warwick
Eleonora Pinto de Moura (2010)

Referee for Peer Reviewed Journals

Community Service:

Built and programmed a Raspberry Pi controlled toy car
UNR Engineering Days at Clay Middle School (2012)

Taught 16 programming workshops
Supplemental instruction at UNR (2012–2013)

Website programmer for public service organization
Council 4997 of the Knights of Columbus (2008–2012)

Volunteer teacher at Our Lady of the Snows School
8th Grade Yearbook Course (2007–2009)

Volunteer teacher at Early Learning Center
1st–3rd Grade Mathematics (2004–2005)

Talks:

1. *Stochastic Parameterization of the Time-Relaxation Model of Turbulence*, University of Nebraska, Lincoln, April 28, 2021.
2. *Data-assimilation and Turbulence Modeling*, Conference on Computational Mathematics and Applications, Las Vegas, Nevada, October 27, 2019.
3. *Numerical Study of Measurement Error in Discrete-in-time Data Assimilation*, SIAM Conference on Analysis of PDEs, La Quinta, California, December 11, 2019.
4. *On the Residual Error in the NS-alpha Family of Turbulence Models*, Workshop on Data Assimilation of Determining Forms held at University of Minnesota on June 21, 2016 just before the 2016 IMA Workshop in Honor of George Sell.
5. *Data Assimilation Using Noisy Time-averaged Measurements*, SIAM Conference on Analysis of PDEs, Scottsdale, Arizona, December 7–10, 2015.
6. *Data Assimilation Using Time-averaged Measurements*, Oxford 38th Conference on Stochastic Processes and their Applications, July 15, 2015.
7. *Statistical Properties of the Residual Error in Turbulence Models*, 2015 Spring Western Section Meeting of the AMS in Las Vegas, April 18, 2015.
8. *Synchonization of Systems of Lorenz Equations using Time Averages* given at the Workshop on Navier–Stokes Equations and Data Assimilation, January 8, 2015 at Texas A&M University.
9. *Data Assimilation for the 2DNS Using Nodal Measurements*, 2014 AMS Sectional Meeting, Texas Tech University, Lubbock Texsas, April 12, 2014.

10. *The Weak Separation Condition and Assouad Dimension: A precise Dichotomy on the Real Line*, Ergodic Theory and Dynamical Systems Seminar, University of Warwick, United Kingdom, February 11, 2014.
11. *Data Assimilation at the 2D NSE using Noisy Data*, Workshop on Nonlinear PDEs and Fluid Flows, University of Maryland, Baltimore County, January 20, 2014.
12. *Continuouse Data Assimilation using Arbitrary Interpolant Observables*, Workshop on Navier-Stokes Equations, Indiana University, February 9, 2013.
13. *Discrete Data Assimilation Using Arbitrary Interpolants*, The 9th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Orlando, Florida, July 2, 2012.
14. *Discrete in Time Data Assimilation for the 2D Navier–Stokes Equations*, Workshop on Navier–Stokes Equations, Texas A&M University, College Station, February 17, 2012.
15. *Discrete in Time Determininining Modes for the 2D Navier–Stokes Equations*, The Conference on Topology, Embeddings and Attractors at Warwick's centre in Venice June 14, 2011.
16. *Discrete Data Assimilation in the 2D Navier–Stokes Equations*, University of California, Irvine, May 16, 2011.
17. *Almost Bi-Lipschitz Embeddings and Almost Homogeneous Sets*, given at University of Southern California, November 10, 2006.
18. *Applied Mathematics at UNR*, given in the Graduate Student Seminar at University of Nevada Reno, October 5, 2006.
19. *The PDEWulf Beowulf Cluster*, a poster presented at the UNR departmental open house, February 14, 2005.
20. *The Number of Determining Modes in Numerical 2D Turbulence*, in the Applied Mathematics Seminar at Indiana on Jan 15, 2004.
21. *The Number of Determining Modes in 2D Turbulence*, SIAM Conference on Applications of Dynamical Systems in Snowbird Utah on May 30, 2003.
22. *Numerical Determining Modes*, Aerodynamics and Flight Mechanics Research Group Seminar Program at the University of Southampton on Jan 15, 2003.
23. *Determining Modes in the LANS-α Model*, Geometrical Mechanics and Turbulence Modeling Workshop in Santa Fe, New Mexico, Nov 9, 2002.
24. *The Number of Determining Modes in 2D Turbulence: A Computational Study*, The Fourth International Conference on Dynamical Systems and Differential Equations, May 25, 2002 UNC at Wilmington.
25. *Continuous Data Assimilation for 2D Naiver-Stokes Equations*, UC Irvine, Applied and Computational Mathematics Seminar, April 15, 2002.
26. *The Number of Determining Modes in Numerical 2D Turbulence*, University of Califonia, Santa Barbara, Applied Mathematics Seminar on March 11, 2002.
27. *The Number of Determining Modes in Numerical 2D Turbulence*, given at the session on Partial Differential Equations and Applications at the Western Section Meeting of the American Mathematical Society on Nov 10, 2001.

28. *The Number of Determining Modes in Numerical 2D Turbulence*, given at the University of Southern California Applied Mathematics Seminar on October 26, 2001.
29. *The Navier–Stokes alpha model of Turbulence*, given at the University of Nevada Reno Chemical Engineering & Mechanical Engineering Joint Research Seminar Series on February 23, 2001.
30. *Turbulence and the alpha-Model of the Navier–Stokes Equations*, given Dec 8, 2000 at the University of Missouri.
31. *The Hölder-Mañé Projection Theorem and some Applications*, given Dec 7, 2000 at the University of Missouri.
32. *Inertially Equivalent Finite Dimensional ODEs*, given Sept 1999 at the University of Nevada, Reno.
33. *Projection Theorems and the Reduction of Infinite Dimensional Dynamics to Finite Dimensions*, given Nov 1998 at Tata Institute of Fundamental Research.
34. *An up to date Report on the Connection between the Camassa–Holm Equations, Turbulent Channel, and Pipe Flows*, a talk given Aug 1998 at Los Alamos Center for Nonlinear Studies (with Shannon Wynne).
35. *Bouligand Dimension and Almost Lipschitz Embeddings*, given February 1998 at Los Alamos Center for Nonlinear Studies.