Elias D. Nino-Ruiz, Ph.D. iD

Contact Information	KM 5 Via Puerto Colombia Barranquilla 080001, ATL, Colombia

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Professional Networks

Personal Website, ORCID, Applied Math and Computer Science Laboratory (AML-CS), and Google Scholar.

Research Interests

Numerical Methods, Data Assimilation, Inverse Problems, Optimization.

Short Bio

Elias D. Nino-Ruiz obtained the Diploma in System Engineering (2007) from the Universidad del Norte (UniNorte) Barranquilla, Colombia, M.S. in System Engineering (2009) and M.S. in Industrial Engineering (2010) from UniNorte, and Ph.D. in Computer Science and Applications (2015) from the Virginia Polytechnic Institute and State University (Virginia Tech) Blacksburg, USA. He worked as an intern at Argonne National Laboratory, USA (2013) and Lawrence Livermore National Laboratory, USA (2014). He served as a research assistant (2011-2015) in the Computational Science Laboratory and an instructor of Numerical Methods (2015) at Virginia Tech. In 2016, he joined UniNorte's Department of Computer Science; he works as an Associate Professor, Chair of the Department of Computer Science, and Director of the Applied Math and Computer Science Laboratory. Nino's research interests are in the area of Computational Science, Applied Mathematics, and Applied Statistics.

Education

Correlation One, New York, NY, USA

> Certificate, Data Scientist, Dec 2020, Graduated with Honors.

Virginia Polytechnic Institute and State University, Blacksburg, VA, USA

> Ph.D., Computer Science & Applications, Dec 2015
> - Thesis: *Efficient Formulation and Implementation of Ensemble based Methods in Data Assimilation*
> - Advisor: Adrian Sandu, Ph.D.
> - GPA: 3.63 out of 4.00

Universidad del Norte (ABET accredited university), Barranquilla, Colombia

> M.S., Industrial Engineering, Apr 2010
> - Thesis: *MODS: A Novel Metaheuristic of Deterministic Swapping for the Multi-Objective Optimization of Combinatorials Problems* (**Summa Cum Laude**)
> - Advisor: Carlos J. Ardila, M.S.
> - GPA: 4.28 out of 5.00

> M.S., System Engineering, May 2009
> - Thesis: *A Novel Algorithm Based on Deterministic Finite Automaton for Solving the Mono-objective Symmetric Traveling Salesman Problem* (**Summa Cum Laude**)
> - Advisor: Carlos J. Ardila, M.S.
> - GPA: 4.45 out of 5.00
> - Outstanding Student

> B.S., System Engineering, Mar 2007
> - Project Topic: *Numerical Methods for Multivariate Optimization*
> - Advisor: Carlos J. Ardila, M.S.
> - GPA: 4.02 out of 5.00
> - Outstanding Student

Research Experience

Director — Spring 2016 to Current
Applied Math and Computer Science Laboratory,
Department of Computer Science
Universidad del Norte, BAQ 080001, Colombia.
Description: Scientific Computing methods for the solution of real-life problems.

Research Assistant — June 2014 to July 2014

Mathematics and Computer Science Division,
Lawrence Livermore National Laboratory
Supervisor: Greg Bronevetsky, Ph.D.
Description: Analysis of sequential data assimilation methods making use of the SIGHT toolbox.

Givens Associate   June 2013 to August 2013
Mathematics and Computer Science Division,
Argonne National Laboratory
Supervisor: Cosmin Petra, Ph.D.
Description: Working on background-error covariance matrix estimation.

Research Assistant   August 2011 to December 2015
Computational Science Laboratory,
Computer Science Department
Virginia Polytechnic Institute and State University
Supervisor: Adrian Sandu, Ph.D.
Description: Working on sequential and variational data assimilation for the weather forecast.

LANGUAGES AND TECHNOLOGIES	• C, C++, FORTRAN, Python, MPI, CUDA, BLAS, LAPACK, MATLAB, SQL, Microsoft Azure, QLik Sense, Tableau, Power BI, Data Studio, and AWS.

WORK
EXPERIENCE
SINCE 2016

Associate Professor, Chair   Spring 2018 - Current
• Department of Computer Science
  Division of Engineering,
  Universidad del Norte, BAQ 080001, Colombia

Instructor of Data Assimilation   Fall 2021
• Ph.D. Program in Mathematical Engineering
  Division of Engineering,
  Universidad EAFIT, MDE 050001, Colombia

Teaching Assistant of Data Science for All   Fall 2020 - Current
• Program of Data Science for All - Colombia
  Correlation-One (DS4A - Colombia),
  United States of America.

Instructor of Data Assimilation   Spring 2020
• Ph.D. Program in Mathematical Engineering
  Division of Engineering,
  Universidad EAFIT, MDE 050001, Colombia

Assistant Professor   Spring 2016 - Fall 2017
• Department of Computer Science
  Division of Engineering,
  Universidad del Norte, BAQ 080001, Colombia

SELECTED
JOURNAL
PUBLICATIONS
SINCE 2016

1. **Nino-Ruiz, E.D.**, Consuegra Ortega, R.S. & Lucini, M.(2023) "Ensemble based methods for leapfrog integration in the simplified parameterizations, primitive-equation dynamics model". *Quarterly Journal of the Royal Meteorological Society*, RMetS, 1– 15.

2. **Nino-Ruiz, E. D.**, Guzman, L., & Jabba, D. (2022). "Ensemble Driven Shrinkage Covariance Matrix Estimation for Sequential Data Assimilation". *International Journal of Artificial Intelligence*, CESER Publications, 2022 Autumn (October), Volume 20, Number 2.

3. **Nino-Ruiz, E. D.**, "A line-search optimization method for non-Gaussian data assimilation via random quasi-orthogonal sub-spaces". *Journal of Computational Science*, Vol. 53, 101373., Elsevier, (2021)

4. **Nino-Ruiz, E. D.**, "A Data-Driven Localization Method for Ensemble Based Data Assimilation". *Journal of Computational Science*, Vol. 51, 101328., Elsevier, (2021)

5. Lopez-Restrepo, S., **Nino-Ruiz, E.D.**, Guzman-Reyes, L.G. et al. "An efficient ensemble Kalman Filter implementation via shrinkage covariance matrix estimation: exploiting prior knowledge". *Computational Geosciences*, Springer, (2021)

6. **Nino-Ruiz, E. D.**. "A Line-Search Optimization Method for Non-Gaussian Data Assimilation Via Random Quasi-Orthogonal Sub-Spaces". *Journal of Computational Science*, Elsevier, 101373.

7. **Nino-Ruiz, E. D.** "A data-driven localization method for ensemble-based data assimilation". *Journal of Computational Science*, Elsevier, 51, 101328. (2021).

8. Lopez-Restrepo, S., **Nino-Ruiz, E. D.**, Guzman-Reyes, L. G., Yarce, A., Quintero, O. L., Pinel, N., & Heemink, A. W. "An efficient ensemble Kalman Filter implementation via shrinkage covariance matrix estimation: exploiting prior knowledge". *Computational Geosciences*, Springer, 1-19 (2021).

9. **Nino-Ruiz, Elias D**. "Hybrid Ensemble Kalman Filter and Markov Chain Monte Carlo Implementations for Non-Gaussian Data Assimilation". *International Journal of Artificial Intelligence*, CESER Publications. Vol 18, No 2. (2020)

10. **Nino-Ruiz, E. D.**, Guzman, L., & Jabba, D. "An ensemble Kalman filter implementation based on the Ledoit and Wolf covariance matrix estimator". *Journal of Computational and Applied Mathematics*, Elsevier, 113163. (2020).

11. Montoya, O.L.Q., **Nino-Ruiz, E.D.** & Pinel, N. "On the mathematical modeling and data assimilation for air pollution assessment in the Tropical Andes". Environ Sci Pollut Res, *Springer*. (2020).

12. **Nino-Ruiz, E.D.**, Mancilla-Herrera, A., Lopez-Restrepo, S., and Quintero-Montoya, O. "A Maximum Likelihood Ensemble Filter Via A Modified Cholesky Decomposition For Non-Gaussian Data Assimilation". *Sensors*, MPDI. (2020).

13. **Elias D. Nino-Ruiz**, Juan C. Calabria-Sarmiento, Luis G. Guzman-Reyes, and Alvin Henao. "A Four-Dimensional Variational Data Assimilation Framework for Wind Energy Potential Estimation". *Atmosphere*, MPDI. (2020).

14. **Nino-Ruiz, E. D.** "A numerical method for solving linear systems in the preconditioned Crank?Nicolson algorithm". *Applied Mathematics Letters*, Eslevier. (2020).

15. **Elias D. Nino-Ruiz**, Rolando Beltran-Arrieta, & Luis Guzman-Reyes. "An adjoint-free four-dimensional variational data assimilation method via a modified Cholesky decomposition and an iterative Woodbury matrix formula". *Non-Linear Dynamics*, Springer. (2019). (HTML)

16. **Nino-Ruiz, E. D.**, & Yang, X. S. "Improved Tabu Search and Simulated Annealing methods for nonlinear data assimilation". *Applied Soft Computing*, Elsevier, 105624. (2019).

17. **Nino-Ruiz, E. D.** "Non-linear data assimilation via trust region optimization". *Computational and Applied Mathematics*, Springer, 38:129 (2019).

18. **Nino-Ruiz, Elias D**; Ardila, Carlos; Estrada, Jesus & Capacho, Jose "A reduced-space line-search method for unconstrained optimization via random descent directions". *Applied Mathematics and Computation*, Elsevier. 15-30 Vol 341 (2019).

19. **Nino-Ruiz, E. D.**, & Morales-Retat, L. E. "A Tabu Search implementation for adaptive localization in ensemble-based methods". *Soft Computing*, Springer. 1-17. (2018).

20. **Nino-Ruiz, Elias D.**; Cheng, Haiyan; and Beltran, Rolando. "A Robust Non-Gaussian Data Assimilation Method for Highly Non-Linear Models" *Atmosphere Journal*, MDPI, 9, no. 4: 126. (2018)

21. **Elias D. Nino-Ruiz**. "Implicit Surrogate Models For Trust Region Based Methods", *Journal of Computational Science*, Elsevier, (2018)

22. **Elias D. Nino-Ruiz**, Adrian Sandu, and Xinwei Deng. "An Ensemble Kalman Filter Implementation Based on Modified Cholesky Decomposition for Inverse Covariance Matrix Estimation", *SIAM Journal on Scientific Computing*, SIAM. 40:2, A867-A886 (2018)

23. **Elias D. Nino-Ruiz**, and Adrian Sandu. "Efficient Parallel Implementation of DDDAS Inference using an Ensemble Kalman Filter with Shrinkage Covariance Matrix Estimation". *Cluster Computing*, Springer. (2017)

24. Vicente Mercado, **Elias D. Nino**, and Carlos Arteta. "Dynamic Site Response Characterization Via Bayesian Inference: Analysis of the SGC Station Deposit in Bogota, Colombia". *Journal of Earthquake Engineering*. Taylor & Francis. (2017).

25. **Nino-Ruiz, Elias D**. "A Matrix-Free Posterior Ensemble Kalman Filter Implementation Based on a Modified Cholesky Decomposition". *Atmosphere Journal*. MDPI. 8.7: 125. (2017)

26. Rao, V., Sandu, A., Ng, M., and **Nino-Ruiz, E. D.** "Robust Data Assimilation Using L_1 and Huber Norms". *SIAM Journal on Scientific Computing*. SIAM. 39(3), B548-B570. (2017)

27. **Nino-Ruiz, Elias D.**, Adrian Sandu, and Xinwei Deng. "A parallel implementation of the ensemble Kalman filter based on modified Cholesky decomposition." *Journal of Computational Science*. Elsevier. (2017).

28. **Nino-Ruiz, Elias D.**, Carlos Ardila, and Rafael Capacho. "Local search methods for the solution of implicit inverse problems". *Soft Computing*. Springer. : 1-14. (2017)

29. Petra, C. G., Zavala, V. M., **Nino-Ruiz, E. D.**, and Anitescu, M. "A high-performance computing framework for analyzing the economic impacts of wind correlation". *Electric Power Systems Research*. Elsevier. Number: 141, 372-380. (2016)

30. **Elias D. Nino Ruiz** Ruiz, Elias D. Nino, and Adrian Sandu. "A Derivative-Free Trust Region Framework for Variational Data Assimilation". *Journal of Computational and Applied Mathematics*. Elsevier. Number: 293, 164–179. (2016)

SELECTED AWARDS	**Research Awards**

- **Best Workshop Paper Award.** "A Surrogate Model Based On Mixtures Of Taylor Expansions For Trust Region Based Methods". ICCS 2017, Zurich, Zwitserland, June 2017.
- **3rd place in the High-Performance Poster Competition**, Virginia Tech, HPC day, Blacksburg, VA, USA, April 2015.
- **Science Merit Diploma**, Universidad el Norte, BAQ, Colombia, February 2011
- **2009 COLCIENCIAS Grantee**, COLCIENCIAS, BOG, Colombia, December 2009
- **Science Merit Diploma**, Universidad el Norte, BAQ, Colombia, September 2009

SELECTED PEER REVIEWS

- Mathematical Geosciences, Springer, February 2022.
- Communications in Statistics: Case Studies, Data Analysis and Applications, Taylor and Francis, February 2022
- Quarterly Journal of the Royal Meteorological Society, Wiley, September 2021.
- Alexandria Engineering Journal, Elsevier, August 2021.
- Pure and Applied Geophysics, Springer, July 2021.
- Inverse Problems in Science & Engineering, Taylor & Francis, February 2021.
- Mechanical Systems and Signal Processing, Elsevier, February 2021.
- Computational Geosciences, Springer, January 2021.
- IEEE Access, IEEE, September 2020.
- Geoscientific Model Development, Copernicus, August 2020.
- IEEE Access, IEEE, June 2020.
- Soft Computing, Springer, April 2020.
- IEEE Access, IEEE, April 2020.
- Applied Ocean Research, Elsevier, December 2019.
- Mechanical Systems and Signal Processing, Elsevier, January 2019.
- Journal of Atmospheric and Solar-Terrestrial Physics, Elsevier, October 2018.
- Cluster Computing, Springer, October 2018.
- Expert Systems With Applications, Elsevier, March 2018.
- Soft Computing, Springer, January 2018.
- Journal of Experimental & Theoretical Artificial Intelligence , January 2018.
- Computing in Science and Engineering, IEEE, November 2017.
- Computing in Science and Engineering, IEEE, September 2017.
- Uncertainty Quantification, SIAM, August 2017.
- Soft Computing, Springer, August 2017.
- Expert Systems With Applications, Elsevier, March 2017.
- Soft Computing, Springer, June 2016.
- Soft Computing, Springer, August 2015.

EDITORIAL BOARDS

- Early Career Advisory Board, Control Engineering Practice Journal, Elsevier. 2021 - present.

- Guest Editor. Special Issue of International Journal of Artificial Intelligence (IJAI) in Machine Learning Methods for Inverse Problems. International Journal of Artificial Intelligence , CESER Publications. Special Issue website. 2021.
- Guest Editor. Special Issue of International Journal of Artificial Intelligence (IJAI) in Combinatorial Optimizaion Methods for Inverse Problems. International Journal of Artificial Intelligence , CESER Publications. Special Issue website. 2018.
- Guest Editor. Special Issue of International Journal of Artificial Intelligence (IJAI) in Combinatorial Optimization. International Journal of Artificial Intelligence , CESER Publications. Special Issue website. 2013.

REFERENCES

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Department of Statistics   E-mail: xdeng@vt.edu
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