# Ebrahim Ghaderpour

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## Degrees

- Doctor of Philosophy, Earth and Space Science and Engineering (Geomatics 2013-2018), York University

  Thesis Title: Least-Squares Wavelet Analysis and Its Applications in Geodesy and Geophysics
  Exceptional Dissertation, GPA: 4.00/4.00
- Doctor of Philosophy, Theoretical and Computational Science (2010-2013), University of Lethbridge

  Thesis Title: Asymptotic Existence of Orthogonal Designs, GPA: 4.00/4.00
- Master of Science, Pure Mathematics (2007-2010), Isfahan University of Technology, GPA: 88.4%
- Bachelor of Science, Applied Mathematics (2003-2007), University of Isfahan, GPA: 86.85%

## Distinctions and Awards

- Governor General's Gold Medal for outstanding academic achievement (May 2019)
- Postdoctoral scholarship from Pacific Institute for the Mathematical Sciences (PIMS)
- Best paper award in geodesy from the Canadian Geophysical Union
- Best presentation award from York University
- Top student at the University of Lethbridge and York University every semester
- On the dean's honor list every semester at Isfahan University of Technology and University of Isfahan
- York research scholarship and awards from York University
- Advantage award and admission award from the University of Lethbridge

## Teaching Certificate

Instructional skills workshop in September 2016, The Educational Development Unit, Taylor Institute for Teaching and Learning, University of Calgary, Calgary, AB, Canada

- Learned how to enhance the quality of teaching to university students and practiced presentations and group facilitation skills (28 hours)

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## Work Experience

- Visiting Researcher, Department of Computer Science, University of Calgary, Calgary, AB, Canada, May 2019
- Remote Sensing Scientist for Farmers Edge company, Lethbridge, AB, Canada, September 2018 - May 2019
- Senior Software Developer for Farmers Edge company, Lethbridge, AB, Canada, May 2016 - September 2018
- Postdoctoral Scholar at the Department of Mathematics and Statistics, University of Calgary, Calgary, AB, Canada, July 2016 - July 2018
- Sessional Instructor at the University of Calgary, Calgary, AB, Canada, September 2016 - January 2018
- Research and Teaching Assistant at the Department of Earth and Space Science, York University, Toronto, ON, Canada, September 2013 - September 2016
- Tutor at Tutor Doctor, October 2015 - July 2016
- Research and Teaching Assistant at the Department of Mathematics and Computer Science, University of Lethbridge, Lethbridge, AB, Canada, September 2010 - September 2013
- Lecturer at Azad University of Najaf-Abad and Tiran, Isfahan, Iran, January 2010 - May 2010

## Research Experience

### Research and Development at Farmers Edge

- Conceptualized and developed several statistical programs in Python for management zone delineation, such as the fuzzy c-means, k-means, natural breaks, and kriging
- Proposed an algorithm that incorporates digital elevation models into multi-year remote sensing satellite images to delineate unsupervised management zones for farms
- Created an excel prototype for crop disease forecasting using a machine learning technique
- Proposed two novel classification techniques, namely, area-weighted and weighted natural breaks that can classify vegetation index and crop health maps
- Developed software programs in Python for fertilizer calculation and cloud-shadow masking

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## Postdoctoral Research at University of Calgary

- Conceptualized seismic signal and image processing and proposed a robust technique of seismic data regularization and random noise attenuation

## Doctoral Research at York University

- Proposed a robust method of analyzing unequally spaced and non-stationary time series, namely, the least-squares wavelet analysis and applied it to analyze time series from Very Long Baseline Interferometry (VLBI) baseline length series, Gravity field and steady-state Ocean Circulation Explorer (GOCE) electrostatic gradiometer measurement disturbances, Global Positioning System (GPS) and superconductive gravimeter data
- Proposed a vigorous method of coherency analysis of two or more unequally spaced and non-stationary time series, namely, the least-squares cross-wavelet analysis and applied it to investigate the coherency and phase differences between the VLBI length series and temperature series and to study the disturbances in the gravitational gradients observed by GOCE satellite that arise from plasma flow in the ionosphere represented by Poynting flux

## Doctoral Research at University of Lethbridge

- Proposed several algorithms to construct new orthogonal designs and Hadamard matrices and introduced signed group orthogonal designs, generalized orthogonal designs, to improve the asymptotic existence of orthogonal designs and Hadamard matrices
- Studied orthogonal designs and Hadamard matrices that have applications in signal processing, coding theory, wireless networking, and communications

## Research Assistant at University of Lethbridge

- Conceptualized Cayley graphs and proved the Hamiltonicity of Cayley graphs of certain orders that have applications in intelligent transportation systems, road networks, and social media

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## Teaching Experience

### Sessional Instructor

Undergraduate courses at the University of Calgary (Calgary, AB, Canada):

- Differential Equations I (AMAT 311) in Fall 2017. Prepared lectures for a class of 115 students**.** Prepared and organized the midterm and final exams
- University Calculus I (MATH 265) in Fall 2017. Prepared lectures for a class of 113 students**.** Held tutorial lab sessions**.** Helped the course coordinator with setting up the exams (commented on the exam questions, distributed the exam sheets, and invigilated the exams)
- Multivariable Calculus for Engineers and Scientists (MATH 277) in Winter 2017. Prepared lectures for a class of 192 students. Held tutorial lab sessions. Helped the course coordinator with setting up the exams (commented on the exam questions, distributed the exam sheets, and invigilated the exams)
- Calculus for Engineers and Scientists (MATH 275) in Fall 2016. Prepared lectures for a class of 218 students**.** Held tutorial lab sessions. Helped the course coordinator with setting up the exams (commented on the exam questions, distributed the exam sheets, and invigilated the exams)

Undergraduate course at Azad University of Najaf Abad (Najaf Abad, Isfahan, Iran):

- Differential Equations in Winter 2010. Prepared lectures and exams for classes of 90 students

Undergraduate course at Azad University of Tiran (Tiran, Isfahan, Iran):

- Calculus in Winter 2010. Prepared lectures and exams for classes of 50 students

### Guest Lectures

Prepared lectures and taught one lecture for each of the following graduate courses at the Department of Mathematics and Statistics, University of Calgary (2016-2017):

- Scientific Computation (MATH 661)
- Computational Finance (AMAT 683)

Prepared lectures and taught parts of the following undergraduate courses at the Department of Earth and Space Science and Engineering, York University (2014-2015):

- Adjustment Calculus (LE/ESSE 3620)
- Analysis of Overdetermined System (LE/ESSE 3630)

### Teaching Assistantships

- Electricity, Magnetism, and Optics for Engineers (PHYS 1801) in Winter 2016. Set up exams and laboratory instruments. Helped students to do experiments and marked their reports
- Earth Environment (ESSE 1012) in Winter 2016. Organized lab sessions and graded exams and assignments
- Adjustment Calculus (LE/ESSE 3620) and Analysis of Overdetermined System (LE/ESSE 3630) in 2014 and 2015. Organized lab sessions and helped students with their assignments. Prepared quizzes for students. Graded quizzes and assignments
- Continuum Mechanics (LE/EATS 2470) in Winter 2014. Helped students with their assignments and graded them. Conducted labs for the instrumental experience
- The Dynamic Earth and Space Geodesy (SC/EATS 1010) in Fall 2013 and Fall 2014. Grouped students for GPS surveying. Tutored and guided students in their assignments and graded them
- The History of Astronomy (SC/NATS 1745) in Summer 2014. Graded online assignments and projects
- Linear Algebra (Math 1410) in 2012 and 2013. Graded midterm and final exams with the course instructor. Counselled students experiencing difficulties in the course
- General lab sessions (2011-2013). Tutored students in the lab sessions several courses, such as Calculus, Statistics, Linear Algebra, Differential Equation, Algebra and Analysis
- Differential Equations I (Math 3600) and Analysis I (Math 3500) in 2010 and 2011. Graded assignments

### Tutoring

Tutor at Tutor Doctor (2015-2016). Tutored students in levels of elementary school, high school, college, and undergraduate. Tutored the following courses: mathematics, statistics, physics, and chemistry

## Public Presentations

- Geoid and its applications, Department of Computer Science, University of Calgary, Calgary, AB, Canada (February 2019)
- Multichannel antileakage least-squares spectral analysis for seismic data regularization beyond aliasing, Diversification Trends in Engineering Technology and Applied sciences (DTETA), Tokyo, Japan (March 2018)
- Anti-leakage least-squares spectral analysis for data regularization, Geo Convention, Calgary, AB, Canada (May 2017)

- Anti-leakage least-squares spectral analysis for data regularization, Consortium for Research in Elastic Wave Exploration Seismology (CREWES), University of Calgary, Calgary, AB, Canada (March 2017)
- Least-squares wavelet analysis and its applications, The 38th Annual Meeting of Alberta Statisticians, University of Alberta, Edmonton, AB, Canada (October 2016)
- Least-squares wavelet analysis and its applications (poster), International Union of Geodesy and Geophysics Prague, Czech Republic (June 2015)
- Least-squares wavelet analysis and stochastic surfaces in the least-squares wavelet analysis (oral), Canadian Geophysical Union, Montreal, Canada (May 2015)
- Signed group orthogonal designs and their applications (oral), Workshop on Algebraic Design Theory and Hadamard Matrices, University of Lethbridge, Canada (July 2014)
- The asymptotic existence of orthogonal design (oral), Number Theory and Combinatorics, University of Lethbridge, Canada (2013)
- Bounds for systems of lines (oral), University of Lethbridge, Canada (2012)

## Computer skills

MATLAB; Python; C++; Maple; Excel; Latex; PowerPoint; Word; Git; Unix

## Software Development

- Developed a software program for seismic data regularization (~1000 lines of code in MATLAB)
- Developed several software programs for management zone delineation using satellite images, such as Planet Scope, RapidEye, Landsat, and Dove (~6000 lines of code in Python)
- Developed a software program for cloud and shadow detection in RapidEye and Landsat images (~800 lines of code in Python)
- Developed a software program in Python for fertilizer calculation (~1500 lines of code in Python)
- Developed a software program and designed a graphical user interface for the least-squares wavelet analysis (~4000 lines of code in C++ and MATLAB)
- Developed a software for factoring polynomials over real numbers and for positioning and the principal component analysis for ArcGIS (~2000 lines of code in Python)
- Developed a software program and designed a graphical user interface for multi-navigation satellite system constellation simulator for positioning and planning purposes (~5000 lines of code in MATLAB)
- Developed a software program for orthogonal designs (~3000 lines of code in Maple)

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## Selected Course Works

Advanced Algebra; Advanced Optimal Estimation Theory and Applications; Advanced Satellite Positioning; Algebra; Algebraic Topology; Analysis; Calculus; Combinatorics; Computational Algebra and Number Theory; Computer Programming; Differential Equations; Discrete Mathematics; Equations with Partial Derivatives; Field Theory; Fourier Analysis; Functional, Real, Complex, and Harmonic Analyses; Geodesy; Geographical Information Systems and Spatial Analysis; Graph Theory; Numerical Analysis; Operations Research; Physics; Photogrammetry; Remote Sensing of the Atmosphere; Statistics and Probability; Stochastic Process; Differential Equations; Times Series; Topics in Design Theory

## Publications

- Ghaderpour E, Rhif M, Ben Abbes A, Pagiatakis S D, Farah I R (2019) Non-stationary and unequally spaced NDVI time series analyses by the LSWAVE software, International Journal of Remote Sensing, Under Review
- Ghaderpour E (2019) Multichannel anti-leakage least-squares spectral analysis for seismic data regularization beyond aliasing. Acta Geophysica, to appear (minor revisions)
- Ghaderpour E, Pagiatakis S D (2019) LSWAVE: a MATLAB software for the least-squares wavelet and cross-wavelet analyses. GPS Solutions, 23(2), doi: 10.1007/s10291-019-0841-3, https://www.ngs.noaa.gov/gps-toolbox/
- Ghaderpour E (2018) Least-squares wavelet analysis and its applications in geodesy and geophysics. Thesis (Ph.D.), York University (Canada), pp. 173
- Ghaderpour E, Ince E S, Pagiatakis S D (2018) Least-squares cross-wavelet analysis and its applications in geophysical time series. Journal of Geodesy, 92(10), 1223-1236
- Ghaderpour E, Liao W, Lamoureux M P (2018) Anti-leakage least-squares spectral analysis for seismic data regularization and random noise attenuation. Geophysics, 8(3), V157-V170
- Ghaderpour E (2018) Constructions for orthogonal designs using signed group orthogonal designs. Discrete Mathematics, 341(1), 277-285
- Ghaderpour E, Pagiatakis S D (2017) Least-squares wavelet analysis of unequally spaced and non-stationary time series and its applications. Mathematical Geosciences, 49(7), 819-844
- Ghaderpour E (2016) Some equal-area, conformal and conventional map projections: a tutorial review. Journal of Applied Geodesy, 10(3), 197-209
- Ghaderpour E (2016) Some non-existence and asymptotic existence results for weighing matrices. International Journal of Combinatorics, 2016, pp. 6. doi:10.1155/2016/2162849
- Ghaderpour E (2015) Some constructions for amicable orthogonal designs. Australasian Journal of Combinatorics, 63(3), 374-384

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- Ghaderpour E (2015) Signed group orthogonal designs and their applications. Algebraic Design Theory and Hadamard Matrices. Springer Proceedings in Mathematics and Statistics,133, 107-123.
- Ghaderpour E, Kharaghani H (2014) The asymptotic existence of orthogonal designs. Australasian Journal of Combinatorics, 58(2), 333-346
- Ghaderpour E (2013) Asymptotic existence of orthogonal designs. Thesis (Ph.D.), University of Lethbridge (Canada), pp. 121
- Ghaderpour E, Morris D (2014) Cayley graphs on nilpotent groups with cyclic commutator subgroup are Hamiltonian. Ars Mathematica Contemporanea, 7(1) 55-72
- Ghaderpour E, Morris D (2012) Cayley graphs of order 30p are Hamiltonian. Discrete Mathematics, 312(24), 3614-3625
- Ghaderpour E, Morris D (2011) Cayley graphs of order 27p are Hamiltonian. International Journal of Combinatorics, 2011, pp. 16, doi:10.1155/2011/206930

## Patents

- Ghaderpour E, Jensen M, Duke G (2019) Refined Average for Zoning Method and System, Farmers Edge Inc.

## Volunteering Work

- Journal Reviewer: IEEE Transactions on Signal Processing, Journal of GPS, Asian Journal of Mathematics and Computer Research, Ars Mathematica Contemporanea, Special Matrices, Discrete Mathematics Algorithms and Applications
- Supervised several undergraduate and graduate students
- An active member of the Calgary Tesla Society http://www.teslasociety.ca/
  Giving presentations in elementary and high schools and demonstrating the levitating light bulb and Tesla plasma globe

## Other Skills (Hobbies)

Bodybuilding; Repairing Vehicles & Electronic Devices; Photography; Biking; Soccer