Farhad Babaee

Curriculum Vitae

Position & Contact Information

2018 – Present **Lecturer** $\simeq$ **US Assistant Professor**, *School of Mathematics, University of Bristol*, Bristol, UK

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- Fry Building, Office 2.13, Bristol, UK
- Full official name: Farhad Babaee Ghasemabadi

Past Positions

– 2018 **Postdoctoral Research Fellow**, *Département de Mathématiques, Université de Fribourg*, Fribourg, Switzerland

– 2016 **Postdoctoral Research Fellow**, *Département de Mathématiques et applications, Ecole Normale Supérieure*, Paris, France

2014 – 2015 **Postdoc / Research Assistant Professor**, *Department of Mathematics and Statistics, Concordia University*, Montréal, Canada

Research Interests

- Interactions of Holomorphic Dynamics and Complex Geometry with Tropical Geometry
- Stratified Morse Theory
- Geometry of Amoebas
- Geometric and Topological Data Analysis

Education

2011 – 2014 **Ph.D. in Pure Mathematics**, *Université de Bordeaux, France – Università di Padova, Italy*

- Dissertation Title: Complex Tropical Currents
- Supervisors: Prof. Alain Yger (Bordeaux), Prof. Andrea D'Agnolo (Padova)
- Note: Trés Honorable

2008 – 2010 **M.Sc. in Mathematics**, *Universiteit Leiden, Holland – Università di Padova, Italy*, Advisor: Prof. Andrea D'Agnolo

- Thesis Title: Integral Transforms of Constructible Functions
- Prof. Andrea D'Agnolo (Padova)

- Note: 110/110 cum laude

2004 – 2007 **M.Sc. in Mathematics**, *Sharif University of Technology, Iran*
Thesis Title: Global Dynamics of Certain ODE Models in Population Biology

- Prof Mohammad R Razvan
- Note: 19/20

2000 – 2004 **Bachelor of Mathematics**, *University of Tehran, Iran*

Certificates

2023 **CREATE HEA Fellowship**

October 2021 **MIT Schwarzman College of Computing**, *Online certificate on* Data Science and Machine Learning: Making Data-Driven decisions

Fall 2017 **InnoSuisse (CTI) Entrepreneurship & Start-Up Training**, *Fribourg, Switzerland*
Organized by Ecole Polytechnique Fédérale de Lausanne (EPFL)

Research

preprint With Sean Dewar and James Maxwell, *Extremal decompositions of tropical varieties and relations with rigidity theory*. arXiv:2403.00655

Dynamical tropicalisation, Journal of Geometric Analysis, A Special Edition in Memory of Nessim Sibony. **33**, 74. (2023). arXiv:2112.09112

With Karim Adiprasito *Convexity of complements of tropical varieties, and approximations of currents*, Math. Ann. (2019), 373: 237. `arXiv:1711.02045`

With June Huh *A tropical approach to a generalized Hodge conjecture for positive currents*, Duke Mathematical Journal **166** (2017), 2749-2813. `arXiv:1502.00299`

preprint *Complex Tropical Currents, Extremality, and Approximations*, Preprint, arXiv:1403.7456

Work in Progress

with Tien-Cuong Dinh (National University of Singapore), *Tropical Dynamics and Intersections*

with Roberto Gualdi (University of Barcelona) and Daniele Turchetti (University of Durham), *Dynamical Tropicalisation on Berkovich Spaces*

Honors, Awards, Fundings

2024 Heilbronn Focused Research Workshop, Budget £6,500 (September 2024)

2023 London Mathematical Society, Research in Pairs Grant, Budget £1200

2021 Heilbronn Focused Research Workshop, Budget £4,500

2019 Heilbronn Focused Research Workshop, Budget £10,000

2015–2016 Postdoctoral Grant from the Laboratory of Excellence of Paris Sciences & Lettres

2011–2014 ALGANT-DOC's grant, full funding for PhD studies in mathematics

2008–2010 ALGANT Masters Scholarship, Erasmus Mundus Scholarship of 42,000 EUR

March 2004 — Rank 12/8500, Iranian National Entrance Examination for Masters degree, Held by Sazman Sanjesh Institute, Iran

April 2002 & 2003 — Two Bronze medals of the Iranian National Mathematics Competitions for University Students, Iranian Mathematical Society, Iran

August 2003 — Honorable Mention, International Mathematics Competitions, Cluj-Napoca, Romania. (IMC 2003)

Professional Activities

Referee — Transactions of AMS, Proc. of the London Mathematical Society, Math. Zeitschrift, Commentarii Mathematici Helvetici

Reviewer — zbMATH, Mathematical Reviews (MathSciNet)

Grant Revewer — The Dutch Research Council (NWO)

Co-organizer — with James Maxwell, Tropical Days in Bristol (LMS meeting)

Cohomology of toric arrangement complement III, Heilbronn Focused Research Workshop, July 2022

Cohomology of toric arrangement complement II, Focused Research Workshop, Queen Mary University of London

with Kevin Grace, Cohomology of toric arrangement complements I, Heilbronn Focused Research Workshop (September 2019)

Mini-course on Combinatorial Hodge Theory, Lectures by Omid Amini, University of Fribourg

Teaching Experience

2022–2024 — Lecturer and Director of Algebraic Geometry, University of Bristol

- Designing new module
- Writing the lecture notes
- Delivering the lectures in-person or pre-recorded or live online as required
- Total of 18 students in two years

2018–2022 — Lecturer of Linear Algebra TB2, University of Bristol

- Teaching mode: face-to-face/live online/pre-recorded videos
- Devised Online Discussion Forums
- Made extracurricular videos discussing the applications
- Liaised with total of ≈40 tutors
- Devised PollEverywhere for interactive Problem Class
- Course director in 2020 and 2021
- Total of ≈1500 students
- Devised interactive non-assessed daily quizzes

- Set online three assessed quizzes
- Made a few extra-curricular videos on applications of Linear Algebra in Machine Learning and Graph Theory
- Set final written exam, and liaised with internal and external exam checkers

2018–2024 Tutor of 31 tutorial classes, University of Bristol. Total of ≈ 400 students.

2020–2022 Lecturer of Mathematical Investigations, University of Bristol, this first-year course content includes

- Discussing time management, teamwork, careers in mathematics
- Supervised introductory projects various topics
- Assessment based on two group project reports
- Teaching LaTeX
- Total of ≈26 students

2016–2018 Teaching Assistant (in English and French) Analysis III, IV Université de Fribourg, Switzerland. Course content included Complex Analysis, Analysis in several variables, Integration on Manifolds, Total of ≈60 students.

2014–2015 Instructor of Math 208: An introductory course on Linear Algebra and Finance, University of Concordia, Montreal, Canada. Total of ≈120 students.

2002–2008 Instructor of Problem Solving Strategies for Highschool Students (Preparations for IMO), Tehran.

2007–2008 Instructor for Foundations of Mathematics, Calculus, Alamé Tabataba-ii University, Iran.

Fall 2004 Instructor for Combinatorics and Linear Algebra Problems of International Mathematics Competitions for University Students (IMC) University of Tehran, Iran.

Supervision

PhD

- Daniel Green Tripp,

Masters

- co-supervised with Tobias Kley (University of Göttingen), Shashwat Upadhyay, Department of Mathematical Engineering *Empirical Analysis of Forecasting Techniques for Prices of Tradable Financial Assets*
- co-supervised with Tobias Kley (University of Göttingen), Sneha Ramesh, Department of Mathematical Engineering *COVID-19 Spread: Comparative study of forecasting techniques from Traditional time series models to Machine Learning models*
- Max Jaworski, *Real Algebraic Geometry and Viro's Patchworking*, 2020.
- Jack Southgate, *Toric and Tropical Geometry*, 2020. Now PhD student at St. Andrews University

Undergraduate

- Arun Steward, *Tropical geometry in Neural Networks*, 2021
- Joshua Cowling, *Tropical Geometry, Amoebas, and Complexity Theory*, 2020

Summer Projects

- Ruta Sliazkaite, *Quantile Regression and Tropical Geometry*, co-supervision with Tobias Kley,

Summer 2020.

Administative Duties

2024 – PhD Admission Tutor

2019 – Library Representative for the School of Mathematics

Relevant Skills

Languages:
- Farsi: Native
- English: Fluent
- French: Upper Intermediate, B1-B2 (European Framework)
- Italian: Basic, A1-A2 (European Framework)

Softwares:
- LaTeX, Python, Maple, Matlab, C++

Selected Talks/Invitations

March 2024 *Dynamical tropicalisation*, Queen Mary University of London, UK

October 2023 *Dynamical tropicalisation*, University of Warwick, UK

August 2023 *Tropical Geometry from Complex Dynamics Standpoint*, Conference on Recent Developments in Algebraic Geometry, Arithmetic and Dynamics, National University of Singapore, Singapore

May 2023 *Dynamical tropicalisation*, University of Bristol, UK

March 2023 *Dynamical tropicalisation*, University of King's College of London, UK

August 2022 *Dynamical tropicalisation*, National University of Singapore, Singapore

May 2022 *Dynamical tropicalisation*, Tropical Mathematics & its Applications/London Mathematical Society meetings, Durham, UK

March 2022 *Dynamical tropicalisation*, Bristol's Ergodic Theory and Dynamical Systems Seminars, Bristol, UK

March 2022 *Dynamical tropicalisation*, Latin American Geometria Algebraica Real y TrOpical Seminar (LAGARTOS), Online Seminars, Recording on BlueJeans

October 2021 *Tropical currents*, Quantitative aspects in complex analysis, geometry and dynamics, University of Lille (Hybrid), France

December 2019 *Tropical Geometry via Currents*, University of Isphahan, Iran

December 2018 *Approximability of tropical currents*, University of Swansea, UK

May 2018 *Two Lectures on Tropical Currents and Toric Varieties*, Université Paris-Sud, Orsay, France

May 2017 *Tropical currents, Winter School on Geometry*, Algebra and Combinatorics of Moduli Spaces and Configurations, Toblach, Italy

November 2016 *Tropical intersection theory*, Bern-Fribourg-Neuchatel Intercity Seminars, Bern, Switzerland

July 2016 *A tropical approach to a generalized Hodge conjecture for positive currents*, 7th European Congress of Mathematics, Mini-Symposium, Berlin, Germany

April 2016 *A tropical approach to a generalized Hodge conjecture for positive currents*, Seminario Geometria Algebraica, University of Barcelona, Spain

March 2016 *On approximability of extremal tropical currents*, Séminaire Géométrie, University of Bordeaux, France

January 2016 *Complex tropical currents*, Weekly Seminars on Arrangements: Combinatorics & Topology, University of Fribourg, Switzerland

January 2016 *On approximability of extremal tropical currents*, Géométrie et Théorie des Modèles, Monthly Seminars, Ecole Normale Supérieure, Paris, France

January 2015 *On approximability of extremal tropical currents*, Analyse et Géométrie, Department of Mathematics of Pierre and Marie Curie University, Paris, France

November 2015 *A tropical approach to the strongly positive Hodge conjecture*, Università degli Studi di Padova, Italy

October 2015 *A tropical approach to the strongly positive Hodge conjecture*, Weekly Seminars in Tropical Geometry, Department of Mathematics of Pierre and Marie Curie University, Paris, France

September 2015 *A non-approximable tropical current*, Ecole Normale Supérieure, Paris, France

June 2014 *Complex Tropical Currents*, PhD defense, Université de Bordeaux, France

June 2014 *Combinatorics of extremal currents*, Séminaire Géométrie, Université de Bordeaux, France

February 2014 *Complex Tropical Currents*, Università di Padova, Italy

February 2012 *Amoebas and Coamoebas*, ALGANT-DOC annual meeting, Université de Bordeaux, France

October 2012 *Geometry of Amoebas*, Geometry Workgroup, Université de Bordeaux, France

September 2010 *Integral transforms of constructible function*, Masters thesis discussion, Università di Padova, Italy

January 2007 *Global Analysis of Certain Models in Biology*, Sharif University of Technology, Iran

September 2006 *Geometrical Aspects in Stability Analysis*, Sharif University of Technology, Iran

March 2006 *Discrete Laplacian*, University of Tehran, Iran

March 2005 *Cycle Index and Applications to Graph Theory*, Sharif University of Technology, Iran

January 2005 *A Topological Proof for van der Waerden Theorem*, Sharif University of Technology, Iran

June 2003 *A Proof of Bruck-Ryser Theorem in Combinatorics*, University of Tehran, Iran

November 2002 *A Proof of Matrix-Tree Theorem*, University of Tehran, Iran

June 2002 *Symbolic Dynamics and Entropy*, University of Tehran, Iran