Farhad Babaee

Curriculum Vitae

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Current Position

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

Past Positions

– 2018	**Postdoctoral Research Fellow**, *Département de Mathématiques, Université de Fribourg*, Fribourg, Switzerland Hosted by Prof. Emanuele Delucchi
– 2016	**Postdoctoral Research Fellow**, *Département de Mathématiques et applications, Ecole Normale Supérieure*, Paris, France. Hosted by Prof. Omid Amini
2014 – 2015	**Postdoc / Research Assistant Professor**, *Department of Mathematics and Statistics, Concordia University*, Montréal, Canada Hosted by Prof. Cody Hyndman

Research Interests

- Interactions of Complex Dynamics, Geometry with Tropical Geometry
- Matroid Theory
- Geometry of Amoebas
- Stratified Morse Theory
- 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*, Mathematische Annalen (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 Reviewer	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
- ○ Set final written exam, and liaised with internal and external exam checkers
- ○ Made a few extra-curricular videos on applications of Linear Algebra in Machine Learning and Graph Theory

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
- ○ Teaching LaTeX
- ○ Supervised introductory projects various topics
- ○ Total of ≈26 students
- ○ Assessment based on two group project reports

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 $\approx$60 students.
2014–2015	Instructor of Math 208: An introductory course on Linear Algebra and Finance, University of Concordia, Montreal, Canada. Total of $\approx$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, started September 2022 - Expected 2026

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