

Vahid Nourozi, PhD

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EDUCATION

- New Mexico State University (NMSU)**, Las Cruces, NM, USA 2023 – Present
- Ph.D. Student in Electronic Engineering
 - Research areas: Quantum error correction and quantum computing
 - Supervisor: Prof. David G. M. Mitchell
 - Relevant Coursework: Quantum error correction, Coding theory, Information Theory, Signal Systems
- Amir Kabir University of Technology (Tehran Polytechnic)**, Tehran, Iran 2016 – 2021
- Ph.D. in Mathematics
 - Thesis: The Rank Cartier Operator and Linear System on Curves
 - Research areas: Algebraic Geometry and Coding theory
 - Supervisors: Prof. Farhad Rahmati and Prof. Saeed Tafazolian
- Universidade Estadual de Campinas (Unicamp)**, Campinas, Brazil 2019 – 2021
- Ph.D. Sandwich in Mathematics
 - Thesis: The Rank Cartier Operator and Linear System on Curves
 - Research areas: Algebraic Geometry and Coding theory
 - Supervisor: Prof. Saeed Tafazolian
- Tarbiat Modares University**, Tehran, Iran 2012 – 2014
- M.S. in Mathematics
 - Thesis: PP-properties in Hurwitz series ring
 - Research area: Non-commutative Algebra
 - Supervisor: Prof. Ahmad Moussavi
- Tafresh University**, Tafresh, Iran 2008 – 2012
- B.Sc. in Mathematics
 - Research area: Pure Mathematics
 - Supervisor: Prof. Ali Parsiyan

RESEARCH INTERESTS

- Quantum error correction
- Quantum computing
- Algebraic Geometry
- Information Theory and machine learning
- Coding theory
- Algebraic Geometry Codes
- Quantum Algorithm

PUBLICATIONS

- [1] **V. Nourozi**, D. G. M. Mitchell. Linear Scaling Quantum LDPC Codes via Balanced Products. Preprint. (2024)
- [2] **V. Nourozi**. Quantum Error Correction with Goppa Codes from Maximal Curves: Design, Simulation, and Performance, to appear Discrete Mathematics, Algorithms and Applications (2024)
- [3] **V. Nourozi**. Application of the Cartier Operator in Coding Theory. Finite Fields and Their Applications, 96, 102419. (2024)
- [4] **V. Nourozi** and B. Mosallaei. The a-number of $y^{q^2+q+1} = x^{q^2+1} + x^q$ over finite fields. Preprint. (2024)
- [5] **V. Nourozi** and Farhad Rahmati, The Rank of the Cartier Operator on Picard Curves, Discrete Mathematics, Algorithms and Applications, 2450028. (2023)
- [6] **V. Nourozi**, Goppa code and quantum stabilizer codes from plane curves given by separated polynomials, Under review in the Finite Fields and Their Applications. (2023)
- [7] V. Nourozi and S. Tafazolian, The a-number of maximal curves of third largest genus, AUT Journal of Mathematics and Computing 3(1), 11-16 (2022)
- [8] **V. Nourozi** and F. Rahmati, The Rank of the Cartier operator on a certain F_q -Maximal function fields. Missouri Journal of Mathematical Sciences 34 (2), 184-190 (2022)
- [9] **V. Nourozi**, F. Rahmati and S. Tafazolian, The a-number of Certain Hyperelliptic Curve. Iranian Journal of Science and Technology, Transactions A: Science, 1-5 (2022)
- [10] **V. Nourozi**, S. Tafazolian and F. Rahmati, The a-number of Certain Maximal Curve. Transactions on Combinatorics, 10(2), pp. 121-128. (2021)
- [11] **V. Nourozi** and F. Rahmati, The a-number of plane curves given by separated polynomials, Submitted. (2021)
- [12] **V. Nourozi** and F. Rahmati, Goppa code and quantum stabilizer codes from plane curves given by separated polynomials. Submitted. (2021)
- [13] V. Nourozi and F. Rahmati, The a-number of special Maximal Curves. Submitted. (2021)
- [14] **V. Nourozi**, F. Rahmati and M. Ahmadi, McCoy property of Hurwitz series rings. Asian-European Journal of Mathematics 14 (06), 2150105. (2020)
- [15] **V. Nourozi** and F. Rahmati, Multivariate Ore Polynomials for Key Exchange Cryptographic Protocols. The Third Conference on Computational Group Theory, Computational Number Theory and Applications, University of Kashan. (2019)
- [16] **V. Nourozi** and M. Afshar, Quantum Codes from Hyperelliptic Curves, Southeast Asian Bulletin of Mathematics 43 (3), 395–400. (2019)
- [17] **V. Nourozi**, A. Moussavi and M. Ahmadi On Nilpotent Elements of Skew Hurwitz Polynomial Rings. Southeast Asian Bulletin of Mathematics, 41 (2), 239-248. (2017)
- [18] M. Ahmadi, A. Moussavi and V. Nourozi, Nilradicals of skew Hurwitz series of rings, Le Matematiche 70 (1), 125-136. (2015)
- [19] **V. Nourozi**, A. Moussavi and K. Sabzipour, Nil α -Skew Armendariz property in skew Hurwitz polynomial rings, Electronic Journal of Mathematics and Its Applications. 1 (1), 14-20. (2015)
- [20] M. Ahmadi, A. Moussavi and **V. Nourozi**, On skew Hurwitz serieswise Armendariz rings, Asian-European Journal of Mathematics 7 (03), 1450036. (2014)
- [21] **V. Nourozi** and A. Moussavi, Armendariz ring of Hurwitz series type. The 23th seminar of algebra, Khansar. (2014)

GRANTS

- ORNL National Lab, US Quantum Information Science, Oak Ridge National Lab, U.S. (2024)
- PHY-1818914, NSF, Quantum Ideas Summer School, Duke Quantum Center. Duke University, U.S. (2024)
- DMS-2303977, NSF, for attending and talking in the 14th Southeastern Quantum structure in the Lie theory workshop. University of Virginia, U.S. (2024)
- Fall NSF Innovation Corps and awarded a scholarship for my innovative concept. Project: Application of Quantum LDPC codes in 5G and IoT, New Mexico State University, U.S. (2023)
- 314966/2018-8, TWAS-CNPq, Research on the Rank of Cartier operator. From Italy (TWAS) and Brazil (CNPq). (2019-2021)

TECHNICAL SKILLS

- **Programming Languages:** Python, C/C++, MATLAB
- **Quantum Computing Frameworks:** Qiskit, Cirq
- **High-Performance Computing:** CUDA, OpenMP
- **Quantum Error Correction:**
 - Stabilizer formalism
 - Topological codes: Surface codes Color codes Toric codes
 - CSS (Calderbank-Shor-Steane) codes
 - Quantum LDPC codes
 - Fault-tolerant quantum computation
 - Bacon-Shor codes
 - Quantum convolutional codes
 - Quantum error detection and correction circuits
 - Syndrome measurement and decoding algorithms
- **Quantum Algorithms:**
 - Grover's algorithm (quantum search)
 - Shor's algorithm (integer factorization)
 - Quantum Fourier Transform (QFT)
 - Quantum Phase Estimation (QPE)
 - Variational Quantum Eigensolver (VQE)
 - Quantum Approximate Optimization Algorithm (QAOA)
 - Quantum walks
 - Deutsch-Jozsa algorithm
 - Simon's algorithm
 - HHL algorithm (for linear systems of equations)
- Quantum Circuit Design and Optimization
- Quantum Error Mitigation Techniques

PROJECTS

- Quantum Error Correction Simulation
 - Implemented Shor's 9-qubit code and surface code for quantum error correction using Qiskit and custom C++ libraries
 - Analyzed performance of minimum-weight perfect matching and belief propagation decoding algorithms
- Large-Scale Quantum Circuit Simulation
 - Developed efficient simulation tools for quantum circuits with up to 50 qubits
 - Utilized parallel computing techniques to optimize performance on CPU/GPU clusters
 - Implemented in C++ and Python, achieving 100x speedup compared to naive implementation

SPECIALIZED KNOWLEDGE

- Quantum Algorithm Design: Grover's algorithm, Quantum Fourier Transform, VQE, QAOA
- Quantum Algorithms and Applications Experience
- Quantum Hardware Experience
- Collaborative and Communication Experience

SUMMER SCHOOLS

- Quantum Ideas Summer School, Duke Quantum Center, Duke University, U.S. (2024)
- US Quantum Information Science, Oak Ridge National Lab, U.S. (2024)
- IBM Quantum Challenge (2024)
- IBM Qiskit Global Summer School (2024)
- Womanium Quantum Program + AI and QWorld (2024)

CERTIFICATES

- **IBM** Qiskit Global Summer School 2024 - Quantum Excellence (2024)
- **IBM** Quantum Challenge 2024 Achievement, Advanced (2024)
- **IBM** Variational Algorithm Design (2024)
- **IBM** Quantum Business Foundation (2024)
- **IBM** Basic of Quantum Information (2024)
- **Ingenii** Quantum Machine Learning Fundamentals Course (2024)
- **Womanium** Quantum computing & Programing + AI program with Qiskit (2024)
- **IBM** Qiskit Global 2024 Achievement, Advanced (2024)
- **Womanium** Quantum Program + AI and QWorld, Quantum Algorithms (2024)
- **Womanium** Quantum Program + AI and QWorld, Quantum Annealing (2024)
- **Classiq Technologies**, Advanced Proficiency in Quantum Algorithm Design (2024)
- **PennyLane** Quantum Machine Learning Challenge at the Womanium Global Quantum +AI Program 2024
- **QWorld** Quantum Computing & Programming with Qiskit using QWorld's introductory tutorial Bronze-Qiskit (2024)
- **Womanium** Womanium Global Quantum+AI Badge 2024 (Module-Based Track) (2024)
- **Womanium** Quantum Computing Hardware Certificate From Qubits to Quantum Computers (2024)

TALKS

- **Overcoming the Distance Barrier: QLDPC Codes with Linear Distance and Dimension**, 3rd edition of NERSC Quantum Days, Berkeley, California, U.S. (2024)
- **Quantum Structure in Algebraic Geometry**, In the 14th Southeastern Quantum Structure in the Lie Theory workshop. University of Virginia, U.S. (2024)

RESEARCH EXPERIENCES

- Study and research on quantum computing – Quantum error correction, Quantum Algorithm, Quantum computing, Quantum encoding and decoding
 - Supervisor: Prof. David Mitchell (New Mexico State University – U.S)
 - 2023 – Present
- Study and research on Algebraic Geometry – Cartier Operator, Coding theory, post-quantum cryptography, information theory
 - Supervisors: Prof. Farhad Rahmti (Amir Kabir University – Iran) and Prof. Saeed Tafazolian (Unicamp- Brazil)
 - 2016 – 2021
- Member of Blockchain group at Amir Kabir University of Technology
 - 2018
- Study and research on Non-commutative Algebra – Group Theory and power series
 - Supervisor: Prof. Ahmad Moussavi
 - 2012 – 2014

HONORS AWARDS

- Awarded Full Scholarship for graduate Program from The World Academy of Science (TWAS), and National Council for Scientific and Technological (CNPq) to study Ph.D Sandwich at Universidade Estadual de Campinas (Unicamp). (2019)
- Invited to the Ph.D interview without exam with master background. (2016)
- Awarded Full Scholarship for graduate Program from the ministry of science, research, and technology to study Ph.D at Amir Kabir University of technology. (2016)
- Top student among 42 graduate students. (2014)
- Awarded Full Scholarship for graduate Program from the ministry of science, research, and technology to study M.Sc. at Tarbiat Modares University. (2012)
- Awarded Full Scholarship for Undergraduate Program from the ministry of science, research and technology to study B.Sc. at Tafresh University. (2008)
- Ranked among top 1 percent in national university entrance exam among over 700,000 participants. (2008)

JOURNAL REVIEWER	<ul style="list-style-type: none"> ▪ Referee of Transactions on Emerging Telecommunications Technologies ▪ Reviewer of American Mathematics Society ▪ Referee of IEEE Transactions on Industrial Informatics ▪ Referee of Discrete Mathematics, Algorithms and Applications ▪ Referee of Peer-to-Peer Networking and Applications ▪ Referee of IEEE Internet of Things IoT ▪ Referee of AUT Journal of Mathematics and Computing
LANGUAGE SKILLS	<ul style="list-style-type: none"> ▪ Persian: Native ▪ English: Fluent ▪ Portuguese: Intermediate
SOCIETY AND COMMITTEE MEMBERSHIP	<ul style="list-style-type: none"> ▪ American Mathematics Society: Association Member, Referee ▪ Iranian Mathematical Society: Association Member
OTHER	<ul style="list-style-type: none"> ▪ Member of the mathematics team of Tafresh University in the country's student mathematics competitions. (2011)
INTERNET LINKS	<ul style="list-style-type: none"> ▪ Google Scholar ▪ GitHub ▪ Publons ▪ LinkedIn ▪ ResearchGate ▪ Academia ▪ Personal Webpage
COMPUTER SKILLS	<ul style="list-style-type: none"> ▪ Technical Software: Magma Software, Sage Software, LaTeX, Python, Qiskit, MATLAB, C/C++, Cirq