

Curriculum Vitae

Sidi Mohamed Beillahi

Postdoctoral Researcher

University of Toronto

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Google Scholar

Linkedin

❖ Research Interests

Software engineering; Software security; Software verification; Distributed systems; Blockchain; Formal verification; Algorithmic verification; Programming languages; Program synthesis.

❖ Education

Ph.D. — Computer Science

Dec 2017 – Mar 2021

Thesis: **Automated Verification of Programs Running on top of Distributed Systems**

Paris Diderot University, France

Advisors: Ahmed Bouajjani and Constantin Enea

Master of Applied Science — Computer Engineering

Sep 2014 – Nov 2016

Thesis: **Towards the Design Automation of Quantum Circuits**

Concordia University, Canada

Advisor: Sofiène Tahar

Engineer's Degree — Polytechnicien

Sep 2011 – Jun 2014

Thesis Title: **Formalization of Signal-Flow Graphs in HOL**

Tunisia Polytechnic School, Tunisia

Advisor: Sofiène Tahar

DEUPC — Mathematics and Physics

Sep 2009 – Jun 2011

Sfax Preparatory Engineering Institute

University of Sfax, Tunisia

❖ Experience

NSERC Postdoctoral Research Fellow, University of Toronto

Jun 2021 – present

Advisors: Fan Long and Andreas Veneris

Toronto, Canada

Mitacs Accelerate Postdoctoral Fellow, University of Toronto and Bank of Canada

Sep 2022 – present

Course Instructor, York University

Jan 2024 – present

Toronto, Canada

Research Consultant, Conflux Network

Dec 2021 – present

Course Instructor, University of Toronto

Sep 2022 – Apr 2023

Research Assistant, Institut de Recherche en Informatique Fondamentale

Dec 2017 – May 2021

Advisors: Ahmed Bouajjani and Constantin Enea

Paris, France

Teaching Assistant, Paris Diderot University

Sep 2018 – Jan 2021

Research Intern, SRI International

Apr 2019 – Aug 2019

Advisor: Michael Emmi

New York City, USA

Software Programmer, TRU Simulation + Training

May 2017 – Dec 2017

Montréal, Canada

Research Assistant, Concordia University

Mar 2014 – Nov 2016

Advisor: Sofiène Tahar

Montréal, Canada

Teaching Assistant, Concordia University

Sep 2015 – May 2016

Research Engineer, Marinvent inc.

Mar 2016 – Nov 2016

Advisor: Sofiène Tahar

Montréal, Canada

Intern, STMicroelectronics

Jul 2013 – Aug 2013

Advisor: Mohamed Ben Ahmed

Tunis, Tunisia

❖ Awards and Recognitions

- ACM SIGSOFT Distinguished Paper Award, ICSE 2024.
- Invited to a Journal Special Issue for Selected OSDI 2023 papers, 2023.
- IEEE ICBC Distinguished Paper Award, 2022.
- Invited to a Journal Special Issue for Selected CONCUR 2019 Papers, 2019.
- Best Undergraduate Thesis, Tunisia Polytechnic School, 2014.
- Ranked 31st in the National Grandes Ecoles Exam, Tunisia, 2011.
- Olympian in the International Mathematical Olympiad, Germany, 2009.
- Ranked 3rd in the National Mathematical Olympiad, Mauritania, 2009.
- Ranked 1st in the National Bac Exam in Mathematics, Mauritania, 2009.

❖ Grants and Scholarships

- PI in two MITACS Accelerate Partnership Grants, 2022 – 2024, CAD 205,500.
- NSERC Postdoctoral Fellowship, 2022 – 2024, CAD 90,000.
- Smart Contract Research Forum Grant, 2022, USD 1,000.
- BMW Scholarship Award for CAV 2016, USD 650.
- Concordia Graduate Student Association Conference Funding for CAV 2016, CAD 100.
- Concordia University Conference and Exposition Award for NFM 2016, CAD 1,000.
- Graduate Student Support Program, Concordia University, 2014 – 2016, CAD 20,000.
- National Scholarship, Mauritania, 2009 – 2014, EUR 13,500.
- Scholarship Award to Participate in the International Mathematical Olympiad, Mauritania, 2009, EUR 1,000.

❖ Service

- Co-organizer, Institut de Recherche en Informatique Fondamentale Verification Seminar, Mar 2020 – July 2020.
- Artificat Evaluation Committees: POPL 2021-2022, CAV 2021, CAV 2024, OOPSLA 2021-2022.
- Extended Review Committees: OOPSLA 2022.
- Sub-Reviewer: FTSCS 2016, VMCAI 2020, CAV 2020, Blockchain 2021, ICDCS 2022, ICBC 2022-2023, TACAS 2024.
- Journal Invited Reviewer: IEEE Transactions on Network and Service Management
- Student Volunteer: CAV 2016.

❖ Journal Publications

J5	<p>LVMT: An Efficient Authenticated Storage for Blockchain 2024</p> <p>Chenxing Li, Sidi Mohamed Beillahi, Guang Yang, Ming Wu, Wei Xu, Fan Long</p> <p>Accepted to the ACM Transactions on Storage</p> <p>Invited special issue for best storage papers from OSDI 2023</p>
J4	<p>LMPT: A Novel Authenticated Data Structure to Eliminate Storage Bottlenecks for High Performance Blockchains Apr 2024</p> <p>Jemin Andrew Choi, Sidi Mohamed Beillahi, Srisht Fateh Singh, Panagiotis Michalopoulos, Peilun Li, Andreas Veneris, Fan Long</p> <p>IEEE Transactions on Network and Service Management, 21(2), 1333 – 1343</p> <p>Invited special issue for best papers from ICBC 2022</p>

- J3 **SigVM: Enabling Event-Driven Execution for Truly Decentralized Smart Contracts** Oct 2022
Zihan Zhao, **Sidi Mohamed Beillahi**, Ryan Song, Yuxi Cai, Andreas Veneris, Fan Long
Proceedings of the ACM on Programming Languages, 6(OOPSLA2), 149:673 – 149:698
- J2 **Robustness Against Transactional Causal Consistency** Feb 2021
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
Logical Methods in Computer Science, 17(1): 12:1 – 12:42
Invited special issue for selected papers from CONCUR 2019
- J1 **A Modeling and Verification Framework for Optical Quantum Circuit** Mar 2019
Sidi Mohamed Beillahi, Mohamed Yousri Mahmoud, Sofène Tahar
Formal Aspects of Computing, 31(3): 321 – 351

❖ Conference Publications

- C19 **HEMVM: a Heterogeneous Blockchain Framework for Interoperable Virtual Machines** 2024
Vladyslav Nekriach, **Sidi Mohamed Beillahi**, Chenxing Li, Peilun Li, Ming Wu, Andreas Veneris, Fan Long
under submission
- C18 **Infernomic: A Decentralized System for Economic LLM Inference** 2024
Haohui Mai, **Sidi Mohamed Beillahi**, Yiyang Zhao, Guanqun Yang, Qianqi Sun, Jingbo Shang, Jiacheng Zhao, Xueqing Liu, Mingyu Gao, Christos Kozyrakis
under submission
- C17 **Demystifying Invariant Effectiveness for Securing Smart Contracts** Jul 2024
Zhiyang Chen, Ye Liu, **Sidi Mohamed Beillahi**, Yi Li, Fan Long
Accepted to ACM International Conference on the Foundations of Software Engineering (FSE 2024)
- C16 **FlashSyn: Flash Loan Attack Synthesis via Counterexample-Driven Approximation** Apr 2024
Zhiyang Chen, **Sidi Mohamed Beillahi**, Fan Long
In Proc. 46th IEEE/ACM International Conference on Software Engineering (ICSE 2024)
- C15 **Safeguarding DeFi Smart Contracts against Oracle Deviations** Apr 2024
Xun Deng, **Sidi Mohamed Beillahi**, Cyrus Minwalla, Han Du, Andreas Veneris, Fan Long
In Proc. 46th IEEE/ACM International Conference on Software Engineering (ICSE 2024)
ACM SIGSOFT Distinguished Paper Award.
- C14 **LVMT: An Efficient Authenticated Storage for Blockchain** Jul 2023
Chenxing Li, **Sidi Mohamed Beillahi**, Guang Yang, Ming Wu, Wei Xu, Fan Long
In Proc. 17th USENIX Symposium on Operating Systems Design and Implementation (OSDI), 2023
Invited to a Special Issue of the ACM Transactions on Storage Journal for Selected OSDI 2023 Papers.
- C13 **A Robust Front-Running Methodology for Malicious Flash-Loan DeFi Attacks** Jul 2023
Xun Deng, Zihan Zhao, **Sidi Mohamed Beillahi**, Han Du, Cyrus Minwalla, Keerthi Nelaturu, Andreas Veneris, Fan Long
In Proc. IEEE International Conference on Decentralized Applications and Infrastructures (DAPPS), 2023
- C12 **Möbius: an Atomic State Sharding Design for Account-Based Blockchains** May 2023
Srisht Fateh Singh, Panagiotis Michalopoulos, **Sidi Mohamed Beillahi**, Andreas Veneris, Fan Long
In Proc. IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2023
- C11 **Comparing Causal Convergence Consistency Models** May 2023
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
In Proc. 11th International Conference on Networked Systems (NETYS), 2023
- C10 **Automated Synthesis of Asynchronizations** Dec 2022
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea, Shuvendu Lahiri
In Proc. 29th Static Analysis Symposium (SAS), 2022
- C9 **Automated Auditing of Price Gouging TOD Vulnerabilities in Smart Contracts** May 2022
Sidi Mohamed Beillahi, Eric Keilty, Keerthi Nelaturu, Andreas Veneris, Fan Long
In Proc. IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022

- C8** **LMPTs: Eliminating Storage Bottlenecks for Processing Blockchain Transactions** May 2022
Jemin Andrew Choi, **Sidi Mohamed Beillahi**, Peilun Li, Andreas Veneris, Fan Long
In Proc. IEEE International Conference on Blockchain and Cryptocurrency (ICBC), 2022
IEEE ICBC Distinguished Paper Award.
- C7** **Smart Contracts Refinement for Gas Optimization** Sep 2021
Keerthi Nelaturu, **Sidi Mohamed Beillahi**, Fan Long, Andreas Veneris
In Proc. 3rd Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), 2021
- C6** **Checking Robustness Between Weak Transactional Consistency Models** Mar 2021
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
In Proc. 30th European Symposium on Programming (ESOP), 2021
- C5** **Behavioral Simulation for Smart Contracts** Jun 2020
Sidi Mohamed Beillahi, Gabriela Ciocarlie, Michael Emmi, Constantin Enea
In Proc. 41st annual ACM SIGPLAN conference on Programming Language Design and Implementation (PLDI), 2020
- C4** **Robustness Against Transactional Causal Consistency** Sep 2019
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
In Proc. 30th International Conference on Concurrency Theory (CONCUR), 2019
Invited to a Special Issue of the Logical Methods in Computer Science Journal for Selected CONCUR 2019 Papers.
- C3** **Checking Robustness Against Snapshot Isolation** Jul 2019
Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
In Proc. 31st International Conference on Computer Aided Verification (CAV), 2019
- C2** **Hierarchical Verification of Quantum Circuits** Jun 2016
Sidi Mohamed Beillahi, Mohamed Yousri Mahmoud, Sofiène Tahar
In Proc. 8th International Symposium NASA Formal Methods (NFM), 2016
- C1** **Formal Analysis of Power Electronic Systems** Nov 2015
Sidi Mohamed Beillahi, Umair Siddique, Sofiène Tahar
In Proc. 17th International Conference on Formal Engineering Methods (ICFEM), 2015

❖ Workshop Publications

- W3** **Formal Analysis of Engineering Systems Based on Signal-Flow-Graph Theory** Jul 2016
Sidi Mohamed Beillahi, Umair Siddique, Sofiène Tahar
In Proc. 9th International Workshop Numerical Software Verification (NSV-CAV), 2016
- W2** **On the Formal Analysis of Photonic Signal Processing Systems** Jun 2015
Umair Siddique, **Sidi Mohamed Beillahi**, Sofiène Tahar
In Proc. 20th International Workshop Formal Methods for Industrial Critical Systems (FMICS), 2015
- W1** **A Tool for the Formal Verification of Quantum Optical Computing Systems** Apr 2015
Sidi Mohamed Beillahi, Mohamed Yousri Mahmoud, Sofiène Tahar
In Proc. Automated Reasoning Workshop (ARW), 2015

❖ Teaching

- Course Instructor at York University
 - EECS3342Z: System Specification and Refinement for 3rd Year Software Engineering Students, Jan 2024 – present.
- Course Co-Instructor at University of Toronto
 - CSC323H1S: Principles of Programming Languages for 3rd Year Computer Science Students, Jan 2023 – Apr 2023.
 - ECE345H1F: Algorithms & Data Structures for 3rd Year Computer Engineering Students, Sep 2022 – Dec 2022.
- Teaching Assistantships at Paris Diderot University

- Automata and Lexical Analysis for 2nd Year Computer Science Students, Sep 2020 – Dec 2020.
- Principles of Binary Machines for 1st Year Computer Science Students, Sep 2020 – Dec 2020.
- Java Programming for 1st Year Computer Science Students, Sep 2019 – Dec 2019.
- Principles of Object-Oriented Programming in Java for 2nd Year Computer Science Students, Sep 2019 – Dec 2019.
- Python Programming for 1st Year Social Science Students, Sep 2018 – Dec 2018.
- Relational Databases and SQL for 2nd Year Computer Science Students, Sep 2018 – Dec 2018.
- Teaching Assistantships at Concordia University
 - Hardware Functional Verification for Graduate and Senior Undergraduate Students, Jan 2016 – Apr 2016.
 - Computer Architecture and Design for Graduate Students, Jan 2016 – Apr 2016.
 - Digital Design for Undergraduate Students, Jan 2016 – Apr 2016.
 - Microprocessors and their Applications for Graduate Students, Sep 2015 – Dec 2015.

❖ Professional Affiliations

ACM (2020); IEEE (2022).

❖ Supervision

- Keerthi Nelaturu, Ph.D. student, University of Toronto
- Zihan Zhao, MASc student, University of Toronto - graduated in 2022
- Zhiyang Chen, Ph.D. student, University of Toronto
- Eric Keilty, MASc student, University of Toronto - graduated in 2023
- Srisht Fateh Singh, MASc student, University of Toronto - graduated in 2023
- Hossein Ghotbaddini, MASc student, University of Toronto - graduated in 2023
- Xun Deng, MASc student, University of Toronto
- Vladyslav Nekriach, MASc student, University of Toronto
- Jacky Zhou, MASc student, University of Toronto

❖ Talks

Securing Smart Contracts Through Program Synthesis

IRIF Verification Seminar, Université Paris Cité (virtual)

Apr 2024

Improving the Reliability and Performance of Distributed Software Systems

School of Information Technology, York University (virtual)

Apr 2024

Automated Synthesis of Asynchronizations

SAS 2022 at SPLASH 2022, Auckland, New Zealand

Dec 2022

SigVM: Enabling Event-Driven Execution for Truly Decentralized Smart Contracts

OOPSLA 2022 at SPLASH 2022, Auckland, New Zealand

Dec 2022

Research Meeting with Bank of Canada, University of Toronto

Jul 2022

Automated Auditing of Price Gouging TOD Vulnerabilities in Smart Contracts

ICBC 2022, Shanghai, China (virtual)

May 2022

Checking Robustness Between Weak Transactional Consistency Models

ANR Project AdeCoDS Meeting, LIP6, Sorbonne University (virtual)

Jun 2021

IRIF Verification Seminar, Paris Diderot University (virtual)

May 2021

ESOP 2021, Luxembourg, Luxembourg (virtual)

Mar 2021

Behavioral Simulation for Smart Contracts

COVID papers at SPLASH 2022, Auckland, New Zealand

Dec 2022

GROUP SEMINAR, University of Toronto (virtual)

Dec 2021

SEMINAR UM6P-CS, Morocco (virtual)

Jul 2020

PLDI 2020, London, UK (virtual)

Jun 2020

Robustness Against Transactional Causal Consistency

IRIF Verification Seminar, Paris Diderot University
CONCUR 2019, Amsterdam, Netherlands

Dec 2019
Sep 2019

Checking Robustness Against Snapshot Isolation

ANR Project AdeCoDS Kick-off Meeting, IRIF, Paris Diderot University
CAV 2019, New York City, USA

Nov 2019
Jul 2019

Formal Analysis of Engineering Systems Based on Signal-Flow-Graph Theory

NSV-CAV 2016

Jul 2016
Toronto, Canada

Hierarchical Verification of Quantum Circuits

NFM 2016

Jun 2016
Minneapolis, USA

Formal Analysis of Power Electronic Systems

Hardware Verification Group Meeting

Oct 2015
Concordia University

On the Formal Analysis of Photonic Signal Processing Systems

Hardware Verification Group Meeting

May 2015
Concordia University

❖ Recent media articles on the work published in C17

Blockchain Security Firm Quantstamp Hopes to Battle Flash Loan Attacks With New Service
Quantstamp unveils tool to detect DeFi flash loan vulnerabilities

CoinDesk - Aug 2023
THE BLOCK - Aug 2023