

# Curriculum Vitae

**Sidi Mohamed Beillahi**

Postdoctoral Researcher

University of Toronto

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Google Scholar

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## ❖ 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

### LVMT: An Efficient Authenticated Storage for Blockchain

Chenxing Li, **Sidi Mohamed Beillahi**, Guang Yang, Ming Wu, Wei Xu, Fan Long  
*Under submission to the ACM Transactions on Storage*

**Invited special issue for best storage papers from OSDI 2023**

2023

### LMPT: A Novel Authenticated Data Structure to Eliminate Storage Bottlenecks for High Performance Blockchains

Jemin Andrew Choi, **Sidi Mohamed Beillahi**, Srisht Fateh Singh, Panagiotis Michalopoulos, Peilun Li, Andreas Veneris, Fan Long

*IEEE Transactions on Network and Service Management*

**Invited special issue for best papers from ICBC 2022**

2023

J5

J4

- 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, Sofiène Tahar  
*Formal Aspects of Computing*, 31(3): 321 – 351

## ❖ Conference Publications

- C18 **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*
- C17 **Demystifying Invariant Effectiveness for Securing Smart Contracts** July 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** April 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** April 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** July 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** July 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

### 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

*Dec 2019*

CONCUR 2019, Amsterdam, Netherlands

*Sep 2019*

### Checking Robustness Against Snapshot Isolation

ANR Project AdeCoDS Kick-off Meeting, IRIF, Paris Diderot University

*Nov 2019*

CAV 2019, New York City, USA

*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

*CoinDesk - Aug 2023*

Quantstamp unveils tool to detect DeFi flash loan vulnerabilities

*THE BLOCK - Aug 2023*