

Curriculum Vitae

Sidi Mohamed Beillahi

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❖ Research Interests

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

❖ Education

Ph.D. — Computer Science

Thesis: **Automated Verification of Programs Running on top of Distributed Systems**
Advisors: Ahmed Bouajjani and Constantin Enea

Dec 2017 – Mar 2021
Paris Diderot University, France

Master of Applied Science — Computer Engineering

Thesis: **Towards the Design Automation of Quantum Circuits**
Advisor: Sofiène Tahar

Sep 2014 – Nov 2016
Concordia University, Canada

Engineer's Degree — Polytechnicien

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

Sep 2011 – Jun 2014
Tunisia Polytechnic School, Tunisia

DEUPC — Mathematics and Physics

Sep 2009 – Jun 2011
Sfax Preparatory Engineering Institute
University of Sfax, Tunisia

❖ Experience

NSERC Postdoctoral Research Fellow, University of Toronto

Advisors: Fan Long and Andreas Veneris

Jun 2021 – present
Toronto, Canada

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

Sep 2022 – present

Research Consultant, Conflux Network

Dec 2021 – present

Course Instructor, University of Toronto

Sep 2022 – Apr 2023

Research Assistant, Institut de Recherche en Informatique Fondamentale

Advisors: Ahmed Bouajjani and Constantin Enea

Dec 2017 – May 2021
Paris, France

Teaching Assistant, Paris Diderot University

Sep 2018 – Jan 2021

Research Intern, SRI International

Advisor: Michael Emmi

Apr 2019 – Aug 2019
New York City, USA

Software Programmer, TRU Simulation + Training

May 2017 – Dec 2017
Montréal, Canada

Research Assistant, Concordia University

Advisor: Sofiène Tahar

Mar 2014 – Nov 2016
Montréal, Canada

Teaching Assistant, Concordia University

Sep 2015 – May 2016

Research Engineer, Marinvent inc.

Advisor: Sofiène Tahar

Mar 2016 – Nov 2016
Montréal, Canada

Intern, STMicroelectronics

Advisor: Mohamed Ben Ahmed

Jul 2013 – Aug 2013
Tunis, Tunisia

Intern, Mauritel S.A

Advisor: Mohamed Moujtaba

Aug 2012 – Aug 2012
Nouakchott, Mauritania

❖ Awards and Recognitions

- 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

- NSERC Postdoctoral Fellowship, 2022 – 2024, CAD 90,000.
- Smart Contract Research Forum Grant, 2022, USD 1,000.
- VMW 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, 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 **LVMT: An Efficient Authenticated Storage for Blockchain** 2023
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
- J4 **LMPT: A Novel Authenticated Data Structure to Eliminate Storage Bottlenecks for High Performance Blockchains** 2023
Jemin Andrew Choi, **Sidi Mohamed Beillahi**, Srisht Fateh Singh, Panagiotis Michalopoulos, Peilun Li, Andreas Veneris, Fan Long
Accepted to the IEEE Transactions on Network and Service Management
Invited special issue for best papers from ICBC 2022
- 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

- C17 **Dymisfying Invariant Effectiveness for Securing Smart Contracts** 2023
 Zhiyang Chen, Ye Liu, **Sidi Mohamed Beillahi**, Yi Li, Fan Long
under submission
- C16 **FlashSyn: Flash Loan Attack Synthesis via Counterexample-Driven Approximation** 2024
 Zhiyang Chen, **Sidi Mohamed Beillahi**, Fan Long
Accepted to the 46th International Conference on Software Engineering (ICSE 2024)
- C15 **Safeguarding DeFi Smart Contracts against Oracle Deviations** 2024
 Xun Deng, **Sidi Mohamed Beillahi**, Cyrus Minwalla, Han Du, Andreas Veneris, Fan Long
Accepted to the 46th International Conference on Software Engineering (ICSE 2024)
- 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

- Behavioral Simulation for Smart Contracts** Jun 2020
C5 Sidi Mohamed Beillahi, Gabriela Ciocarlie, Michael Emmi, Constantin Enea
In Proc. 41st annual ACM SIGPLAN conference on Programming Language Design and Implementation (PLDI), 2020
- Robustness Against Transactional Causal Consistency** Sep 2019
C4 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.
- Checking Robustness Against Snapshot Isolation** Jul 2019
C3 Sidi Mohamed Beillahi, Ahmed Bouajjani, Constantin Enea
In Proc. 31st International Conference on Computer Aided Verification (CAV), 2019
- Hierarchical Verification of Quantum Circuits** Jun 2016
C2 Sidi Mohamed Beillahi, Mohamed Yousri Mahmoud, Sofiène Tahar
In Proc. 8th International Symposium NASA Formal Methods (NFM), 2016
- Formal Analysis of Power Electronic Systems** Nov 2015
C1 Sidi Mohamed Beillahi, Umair Siddique, Sofiène Tahar
In Proc. 17th International Conference on Formal Engineering Methods (ICFEM), 2015

❖ Workshop Publications

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

❖ Teaching

- 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