Dr Saurabh Joshi

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Professional Experience

- **Director of R&D — Oct 2024–Present**

  Supra, Hyderabad, India (Remote).
  - Technical Product Owner and Architect for DORA 2.0, an oracle solution from Supra
  - Technical Product Owner and Architect for Supra Native Automation for Move and EVM
  - Leading smart contract development efforts for AutoFi, DORA, Automation, Indices
  - Leading efforts on Supra specific adaptations for Move language
  - Member of multisig authority for Supra Foundation
  - Design inputs for SupraLiquid/Microchain, Supra EVM
  - Leading internal audit efforts for smart contracts at Supra including HyperNova, DORA, AutoFi

- **Principal Researcher — May 2022–Sep 2024**

  Supra, Hyderabad, India (Remote).
  - Key contributor in planning technological road-map for Supra
  - Application layer design, implementation and adaptation for Supra Framework in Move programming language
  - Leading efforts on native blockchain automation service
  - Leading and coordinating effort on novel design for blockchain oracle from conceptualization to production
  - Leading a team of smart contract developers for providing oracle and VRF (Verifiable Random Function) services to various networks based on EVM, Move VM, Radix, CosmWasm
  - Initiated efforts on formal specifications and verification of Move contracts
  - Published a research paper as well as a US patent based on our novel oracle design
  - Probabilistic analysis of oracle and moonshot protocol
  - Coordinating, supervising and helping the engineering team on various aspects pertaining to oracle services, SMR, and smart contract development
  - Helping in assessment and hiring

- **Staff Engineer, Product Security — Oct 2021–May 2022**

  Qualcomm, Hyderabad, India.
  - Led and coordinated Security Validation team of 12 engineers in developing proof-of-concept exploits for reported vulnerabilities on mobile software stack
  - Led and coordinated team of 3 engineers for countermeasure testing for mobile chipsets
  - Developed university relations within India for Qualcomm security group
  - People management of engineering team

- **Assistant Professor Grade I — May 2016–Sep 2021**

  Department of CSE, IIT Hyderabad, India. Tools developed: GPURepair, Open-WBO-Inc, Pinaka, Shesha, GoProver, LLVM2GOTO

- **Assistant Professor (Grade I) — Sep 2015–May 2016**

  Department of CSE, IIT Guwahati, India.

- **Post Doctoral Research Fellow — Aug 2012–Aug 2015**

  Department of Computer Science, University of Oxford, UK. Tools developed: cbmc-repair, 2LS, Open-WBO, Walcyrie^[Approved artefact for PPoPP 2016], VerifOx

- **Research Intern — May 2010–Sep 2010, Feb 2011–Apr 2011**
  Rigorous Software Engineering group, Microsoft Research, India. Tools developed: Cbugs, AtomicInf

- **Project Trainee — Aug 2006–Jul 2007**
  Software Engineering group, IBM India Research Lab, New Delhi, India. Tools improved: SAFE

Patents
- "**Finding Bugs with Low False Alarms and Under-specified Harness**" *Saurabh Joshi*, Shuvendu Lahiri and Akash Lal US patent number: 8793664. Patent Granted.
- "**Distributed Oracle Agreement System and Method (DORA)**", *Saurabh Joshi*, Aniket Kate, Joshua Tobkin and David Yang, US Patent App. No: PCT/US/36923

Research Articles
1. "**LLOR: Automated Repair of OpenMP Programs**" Utpal Bora, *Saurabh Joshi*, Gautam Muduganti and Ramakrishna Upadrasta, VMCAI 2025

2. "**GPURepair: Automated Repair of GPU Kernels (Extended Version)**" *Saurabh Joshi* and Gautam Muduganti Sadhana, A Journal of Indian Academy of Sciences, Vol. 49, 2024.

3. "**Oracle Agreement: From an Honest Super Majority to Simple Majority**" Prasanth Chakka, *Saurabh Joshi*, Aniket Kate, Joshua Tobkin and David Yang IEEE 43rd International Conference on Distributed Computing Systems (ICDCS), 2023.

4. "**OpenMP aware MHP Analysis for Improved Static Data-Race Detection**" Utpal Bora, Shraiysh Vaishay, *Saurabh Joshi* and Ramakrishna Upadrasta LLVM-HPC, 2021.

5. "**Anomaly Detection in Data Plane Systems using Packet Execution Paths**" Archit Sanghi, Praveen Tammana, *Saurabh Joshi* and Krishna P Kadiyala ACM SIGCOMM SPIN 2021

6. "**GPURepair: Automated Repair of GPU Kernels**"^[received all 3-star from Artefact Evaluation Committee] *Saurabh Joshi* and Gautam Muduganti International Conference on Verification, Model Checking and Abstract Interpretation (VMCAI 2021)

7. "**On the Tractability of (k, i)-coloring (Extended Version)**" Sriram Bhyravarapu, *Saurabh Joshi*, Subrahmanyam Kalyanasundaram and Anjeneya Swami Kare Discrete and Applied Mathematics (DAM), 2020

8. "**LLOV: A Fast Static Data-race Checker for OpenMP Programs**" Utpal Bora, Santanu Das, Pankaj Kukreja, *Saurabh Joshi*, Ramakrishna Upadrasta and Sanjay Rajopadhye ACM Transactions on Architecture and Code Optimizations (ACM TACO), Vol. 17 (4), 2020

9. "**Phase Transition Behavior of Cardinality and XOR constraints**" Yash Pote, *Saurabh Joshi* and Kuldeep Singh Meel 28th International Joint Conference on Artificial Intelligence (IJCAI 2019)

10. "**Open-WBO-Inc: Approximation Strategies for Incomplete Weighted MaxSAT**"^[Received Open Science badge] *Saurabh Joshi*, Prateek Kumar, Sukrut Rao and Ruben Martins Journal on Satisfiability, Boolean Modelling and Computation, Vol. 11, pp. 73–97, 2019.

11. "**Pinaka: Symbolic Execution meets Incremental Solving (Competition Contribution)**" Eti Chaudhary and *Saurabh Joshi* TOOLympics, TACAS 2019.

12. "**Approximation Strategies for Incomplete MaxSAT**" *Saurabh Joshi*, Prateek Kumar, Ruben Martins and Sukrut Rao 24th International Conference on Principles and Practices of Constraint Programming (CP 2018)

13. "**On the tractability of (k,i)-coloring**" *Saurabh Joshi*, Subramaniam Kalyanasundaram, Anjeneya Swami Kare and Bhyravarapu Sriram 4th International Conference on Algorithms and Discrete Applied Mathematics (CALDAM 2018)

14. "**Precise Predictive Analysis for Discovering Communication Deadlocks in MPI Programs**" Vojtech Forejt, *Saurabh Joshi*, Daniel Kroening, Ganesh Narayanaswamy and Subodh Sharma ACM Transactions on Programming Languages and Systems (TOPLAS 2017)

15. "**Equivalence Checking of a Floating-point Unit against a High-level C Model**" Rajdeep Mukherjee, *Saurabh Joshi*, Andreas Griesmayer, Daniel Kroening and Tom Melham 21st International Symposium on Formal Methods (FM 2016)

16. "**The Virtues of Conflict : Analyzing Modern Concurrency**"^[Received Approved Artefact badge] Ganesh Narayanaswamy, *Saurabh Joshi*, and Daniel Kroening 21st Symposium on Principles and Practice of Parallel Programming (PPoPP 2016)

17. "**On Using Incremental Encodings in Unsatisfiability-based MaxSAT Solving**" Ruben Martins, *Saurabh Joshi*, Vasco Manquinho and Inês Lynce Journal on Satisfiability, Boolean Modelling and Computation, Vol. 9, 2015.

18. "**Generalized Totalizer Encoding for Pseudo-Boolean Constraints**" *Saurabh Joshi*, Ruben Martins and Vasco Manquinho 21st International Conference on Principles and Practices of Constraint Programming (CP 2015)

19. "**Safety Verification and Refutation by k-invariants and k-induction**" Martin Brain, *Saurabh Joshi*, Daniel Kroening, Peter Schrammel 22nd International Static Analysis Symposium (SAS 2015)

20. "**Property-Driven Fence Insertion using Reorder Bounded Model Checking**" *Saurabh Joshi* and Daniel Kroening 20th International Symposium on Formal Methods (FM 2015)

21. "**Incremental Cardinality Constraints for MaxSAT**"^[Chosen as the most cited paper from CP 14. Invited to write an article for the Virtual Volume created to celebrate 25 years of CP] Ruben Martins, *Saurabh Joshi*, Vasco Manquinho and Inês Lynce 20th International Conference on Principles and Practices of Constraint Programming (CP 2014)

22. "**A New Method of MHP Analysis for Languages with Dynamic Barriers**" *Saurabh Joshi*, R K Shyamasundar and Sanjeev Aggarwal 17th International Workshop on High-Level Parallel Programming Models and Supportive Environments (HIPS), IPDPS Workshops, 2012

23. "**Under-specified Harness and Interleaved Bugs**" *Saurabh Joshi*, Shuvendu Lahiri and Akash Lal 39th Symposium on Principles of Programming Languages (POPL 2012)

24. "**Distributed Generalized Dynamic Barrier Synchronization**" Shivali Agrawal, *Saurabh Joshi*, and R K Shyamasundar 12th International Conference on Distributed Computing and Networking (ICDCN 2011)

25. "**Reactivity in SystemC Transaction-Level Models**" Frederic Doucet, R K Shyamasundar, Ingolf Krueger, *Saurabh Joshi*, and Rajesh Gupta Haifa Verification Conference (HVC 2007)

Talks

1. "Invited talk on **Web3 and Program Analysis** at IICT (CompilerTech) 2024." [video]
2. Invited talk on **Distributed Oracle Agreement with Simple Majority** at IIT Hyderabad August 2023
3. "Talk on **Supra Automation Network** as part of The Tech Behind Supra webinar series." [video]

4. "Invited talk on **DORA** at Ethereum Engineering Group meetup." [video]
5. "**Code Contract: What, Why and How?**" at CppIndiaCon 2021." [video], [slides], [code]
6. "**GPURepair: Automated Repair of GPU Kernels**", at Qualcomm (Feb 2021).
7. "**Approximation Strategies for Incomplete MaxSAT**", at IIT Delhi (June 2018), CP, Lille, France (August 2018), at the fourth Indian SAT+SMT School at IIT Bombay (December 2019).
8. "**Generalized Totalizer Encoding for Pseudo-Boolean Constraints**", at Second Indian SAT+SMT School, Mysore Park, 2017
9. "**How to establish research collaboration with researchers in your domain (India/ Outside)?**", at Research Workshop organized by YP affinity group, IEEE Hyderabad section, IIIT Hyderabad, 2017.
10. "**Property-driven Fence Insertion using Reorder Bounded Model Checking**", at IIIT Vadodara (Sep 2015), IIT Delhi (Nov 2015), IIT Madras (May 2015), IIT Kharagpur (May 2015), IIT Hyderabad (May 2015), IIIT Delhi (May 2015), IIT Kanpur (May 2015), FM, Oslo, Norway (June 2015).
11. "**Little Pain Big Gain: Role of tricks in constraint solving**", at IIT Delhi (Nov 2015).
12. "**Interleaved Bugs and Under-specified Harness**", Mysore Park Workshop on The Future of Debugging, Mysore, 2012.
13. "**What is this FOSS (Free and Open Source Software) all about?**", A Linux and FOSS awareness talk at Krishna Institute of Technology, Kanpur, April 2010.

Honours and Awards

- SV-COMP 2021, 2nd place in ReachSafety-Floats and ReachSafety-Loops, 3rd place in ReachSafety-Combinations subcategories (Pinaka)
- **Excellent** rating for SERB ECR grant
- SV-COMP 2020, 3rd place in ReachSafety-Floats subcategory (Pinaka)
- MaxSAT Evaluations 2019: 2 Bronze (Open-WBO-Inc)
- SV-COMP 2019, 2nd place in ReachSafety-Floats subcategory (Pinaka)
- MaxSAT Evaluations 2018: 1 Gold, 1 Silver (Open-WBO-Inc)
- MaxSAT Evaluations 2017: 2 Gold, 1 Silver (Open-WBO)
- DST Early Career Research Award 2017
- Pseudo Boolean Evaluations 2016: 2 Silver, 2 Bronze (Open-WBO)
- MaxSAT Evaluations 2015: 1 Gold, 1 Silver (Open-WBO)
- MaxSAT Evaluations 2014: 1 Gold, 1 Silver (Open-WBO)
- SVCOMP 2016: 1 Gold (2LS aka summarizer)

Funding

- Development of Indian Telecommunication Security Assurance Requirements — Aug 2020–Aug 2022 Role: Co-PI Funding Agency: NSCS, India Funds: ₹ 276.79 Lakh (share as Co-PI: ₹ 60 Lakh) (Project granted but left due to moving to industry)

- Validating and Securing Network Protocols and Network Management System — Aug 2020–Aug 2023 Role: Co-PI Funding Agency: NSCS, India Funds: ₹ 150 Lakh (share as Co-PI: ₹ 75 Lakh) (Project granted but left due to moving to industry)

- Auto Grade Linux Project — Apr 2020–Mar 2021 Role: Consultant/Co-PI Funding Agency: Suzuki Motor Corporation, Japan Funds: ₹ 31.97 Lakh (share as Co-PI: ₹ 6.88 Lakh)

- Workshop on Program Analysis and Verification — Feb 2019 Role: PI/Instructor Funding Agency: CDAC Funds: ₹ 6.78 Lakh (share: ₹ 3.39 Lakh)

- Scope Enrichment of Verification Technologies — Aug 2017–Aug 2020 Role: Sole Principal Investigator Funding Agency: SERB, DST, India Funds: ₹ 22.5 Lakh

- Bridging the gap between programming languages and verification tools — Nov 2016–Nov 2018 Role: Sole Principal Investigator Funding Agency: IIT Hyderabad, India Funds: ₹ 3 Lakh

Research Interests
- Program analysis and verification
- Constraint solving and optimization
- Formal verification
- Blockchain
- Compiler

Mentorship and Supervision

Ongoing
- Gautam Muduganti (PhD)

Completed
- Utpal Bora (PhD), IIT Hyderabad, — (Jan 2019 - Oct 2022)(co-supervised with Dr. Ramakrishna Upadrasta) **Techniques for Static Detection of Data-races in OpenMP Programs**
- Anilava Kundu (MTech RA) — (co-supervised with Dr. Ramakrishna Upadrasta)
- Akash Banerjee (MTech RA), IIT Hyderabad — Aug 2018–June 2021 **Proteus: Polymorphic Compilation and Execution to Mitigate Control-Channel Attacks**
- Archit Sanghi (MTech), IIT Hyderabad — Apr 2020–July 2021 (co-supervised with Dr. Praveen Tammana) **Anomaly Detection using Packet Execution Paths**
- Eti Chaudhary (MTech RA), IIT Hyderabad — Aug 2017–July 2020 **Verification of Programs : Pinaka & GBMC**
- Aditya Kumar (MTech), IIT Hyderabad — Apr 2019–July 2020 (co-supervised with Dr. Ramakrishna Upadrasta) **Code Compliance Checker**
- Sunil Sarode (MTech), IIT Hyderabad — Apr 2019–July 2020 (co-supervised with Dr. Ramakrishna Upadrasta) **Code Compliance Checker**
- Uttaran Sinha (MTech), IIT Hyderabad — Apr 2018–June 2019 (co-supervised with Dr. Vineeth Balasubramanian) **Defending Deep Neural Networks against Structural Perturbations**
- Arpit Aggarwal (MTech), IIT Delhi — June 2017–June 2018 (co-supervised with Dr. Subodh Sharma, IIT Delhi) **GoProver: A Bounded Model-Checker for GO Programs**
- Rasika Sapate (MTech), IIT Hyderabad — Jan 2017–June 2018 **LLVM2GOTO: A translator from LLVM IR to CPROVER IR**
- Prateek Kumar (BTech) (Honors Project), IIT Hyderabad — Dec 2017–May 2019 **Approximation Strategies for MaxSAT**
- Sukrut Rao (BTech), IIT Hyderabad — Dec 2017–May 2019 **Approximation Strategies for MaxSAT**
- Gitanjali Mannepalli (BTech) (Mini Project), IIT Hyderabad — July 2018–Nov 2018 **Proving program correctness using Coq**
- Nidhi Dhamnani (BTech) (Research Internship), IIT Hyderabad — July 2017–Nov 2017 **Optimizing SAT solver for Push/Pop queries**
- B Shreya (BTech), IIT Hyderabad — July 2017–Nov 2017 **Optimizing SAT solver for Push/Pop queries**

Teaching
- Total of **44 credits** of courses at IIT Hyderabad

- Instructor: **Constraint Solving/Constraint Programming - Graduate Elective** — Jan 2020–Apr 2020, Jan 2019–Apr 2019, Aug 2017–Oct 2017, Aug 2016–Sep 2016
- Instructor: **Software Verification - Graduate Elective** — Aug 2019–Dec 2019, Jan 2018–Apr 2018, Jan 2017–Apr 2017
- Instructor: **Software Development Fundamentals** — Mar 2021–Aug 2021
- Instructor: **Introduction to Programming** — Nov 2020–Mar 2021
- Instructor: **Principles of Programming Languages II - Undergraduate** — Feb 2020–Mar 2020, Jan 2019–Apr 2019, Jan 2018–Apr 2018, Jan 2017–Apr 2017
- Instructor: **Principles of Programming Languages I - Undergraduate** — May 2020–July 2020, Oct 2019–Dec 2019, Oct 2018–Dec 2018, Oct 2017–Dec 2017, Oct 2016–Dec 2016
- Coordinator/Instructor: **Software Engineering - Undergraduate** — Jan 2017–Apr 2017
- Instructor: **Software Engineering - Undergraduate**, **Software Engineering Lab** — Jan 2016–Apr 2016, IIT Guwahati
- Class tutor for **Software Verification - Graduate Elective** — Hillary term 2015, University of Oxford
- Teaching assistant for **Advanced Compiler Optimizations - Graduate Elective** — Jan 2012–Apr 2012 (Instructor: Dr Amey Karkare, IIT Kanpur)
- Teaching assistant for **Data Streaming Algorithms - Graduate Elective** — Jul 2008–Dec 2008 (Instructor: Prof. Sumit Ganguly, IIT Kanpur)

Skills

Technical Skills

(▲) indicates extensive experience
- **Programming Languages:** (▲)Move (▲)C++, (▲)C, Python, Rust, Solidity, Java, C#
- **Verification Framework:** (▲)CPROVER/CBMC, Boogie
- **Compilation Framework:** LLVM
- **Scripting Languages:** (▲)bash
- **Build System:** (M)ake, CMake, Cargo
- **Cloud:** Google Cloud Compute Engines
- **Documentation:** (▲)Markdown, (▲)LaTeX, Typst
- **Version Control:** (▲)git, svn
- **Development Tools:** (▲)GitHub, (▲)Eclipse, (▲)Vim, VSCode, GitHub Actions, GDB
- (▲)Linux System Administration
- **AI tools:** Copilot, Gemini for planning, design, development and testing

Soft Skills
- Excellent communication skills, both written and verbal
- Strong leadership and team management skills
- Ability to work effectively in a remote and distributed team environment
- Strong problem-solving and analytical skills
- Ability to mentor and guide junior team members
- Experience in collaborating with cross-functional teams and stakeholders
- Ability to adapt to new technologies and tools quickly

Services

Academic Service
- PhD Evaluation Committee for Dhriti Khanna, IIIT Delhi
- Organizer: Eighth Indian SAT+SMT School held at IIIT Hyderabad 15-17 December 2023

- Organizer: Seventh Indian SAT+SMT School 15-17 December 2022 held at IIT Madras
- Organizer: Sixth Indian SAT+SMT School 2021 (virtual) 10–12 December 2021
- PRSG (Project Review and Steering Group) Member, MeiTy project: "Design and Development of a Solution for Vulnerability Detection in Embedded Device Firmware" — Dec 2019–July 2021
- Organizer: Fifth Indian SAT+SMT School 2020 (virtual) 11–13 December 2020
- Organizer: "Workshop on Program Analysis : Theory and Practice" held at CDAC Hyderabad — Feb 2020
- Organizer: Fourth Indian SAT+SMT School 2019 held at IIT Bombay 8–10 December 2019
- Organizer: Formal Methods Update Meeting 2019 held at IIT Hyderabad on 10–11 July 2019
- Organizer: Third Indian SAT+SMT School 2018 at IIIT Hyderabad
- Associate Editor (2018–2020): Sadhana, Journal of Indian Academy of Sciences
- Reviewer/PC/AEC: CompilerTech 2025, CompilerTech 2024, AAAI 2020, CAV 2019, ASV 2019, JPDC, IDC 2018, CAV 2018, ICEGOV 2017, IDC 2016, ISSTA 2016, TACAS 2015, VMCAI 2015, HVC 2014, CAV 2014, VSTTE 2013, HiPC 2010, PPoPP 2010, Hack.IN 2009

Education
- **Doctor of Philosophy**, Computer Science — Jul 2007–Feb 2013 IIT Kanpur.
  ‣ Thesis submitted in July 2012

- **Master of Technology** (with Research Assistantship), Computer Science — July 2003–July 2006 IIT Bombay.

- **Bachelor of Engineering**, Information Technology — Sep 1999–Jul 2003 GCET, Sardar Patel University.