

# Sergey Mechtaev

Lecturer (Assistant Professor), University College London

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## RESEARCH INTERESTS

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- **Automated Programming:** automated program repair, program synthesis
- **Program Analysis:** symbolic execution, Datalog-based analysis, verification.
- **DevOps:** containers, configuration languages.

## EDUCATION

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- **National University of Singapore, School of Computing** Singapore  
*Doctor of Philosophy*  
August 2012–July 2018  
Thesis: Semantic program repair; Supervisor: Abhik Roychoudhury; GPA: 4.4
- **Saint Petersburg State University, Mathematics & Mechanics Faculty** Saint Petersburg, Russia  
*Specialist*  
September 2006–July 2011  
Thesis: Generic programming library for OCaml; Supervisor: Dmitry Boulytchev; GPA: 4.7

## EMPLOYMENT

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- **University College London** London, United Kingdom  
*Lecturer*  
February 2019–Present  
Software System Engineering group, CREST centre
- **National University of Singapore** Singapore  
*Research Assistant*  
March 2017–January 2019  
TSUNAMi centre
- **Fondazione Bruno Kessler** Trento, Italy  
*Intern*  
February 2016–June 2016  
Research Unit in Embedded Systems
- **Lanit-Tercom, Inc** Saint-Petersburg, Russia  
*Software Developer*  
May 2010–July 2012  
HaSCoL hardware-description language
- **OOO Dvin** Saint-Petersburg, Russia  
*Software Developer*  
June 2009–April 2010  
Video surveillance software startup

## PUBLICATIONS

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**Google Scholar:** <https://scholar.google.com.sg/citations?user=XTFR93cAAAAJ&hl=en>

**DBLP:** <https://dblp.uni-trier.de/pers/hd/m/Mechtaev:Sergey>

- **Continuously Accelerating Research** ICSE'23 NIER  
*Jonathan Bell, Christopher Timperley, Sergey Mechtaev, Earl Barr, Michael Hilton*  
International Conference on Software Engineering 2023, New Ideas and Emerging Results
- **Rete: Learning Namespace Representation for Program Repair** ICSE'23  
*Nikhil Parasaram, Earl Barr, Sergey Mechtaev*  
International Conference on Software Engineering 2023

- **Efficient SMT-based Network Fault Tolerance Verification**  
*Yu Liu, Pavle Subotic, Emmanuel Letier, Sergey Mechtaev, Abhik Roychoudhury*  
 International Symposium on Formal Methods 2023

FM'23
- **Modus: A Datalog Dialect for Building Container Images**  
*Chris Tomy, Tingmao Wang, Earl Barr, Sergey Mechtaev*  
 Symposium on the Foundations of Software Engineering 2022

FSE'22
- **Fair Decision Making via Automated Repair of Decision Trees**  
*Jiang Zhang, Ivan Beschastnikh, Sergey Mechtaev, Abhik Roychoudhury*  
 International Workshop on Equitable Data & Technology 2022

Fairware'22
- **Trident: Controlling Side Effects in Automated Program Repair**  
*Nikhil Parasaram, Earl Barr, Sergey Mechtaev*  
 Transactions on Software Engineering

TSE'21
- **Evaluating Automatic Program Repair Capabilities to Repair API Misuses**  
*Maria Kechagia, Sergey Mechtaev, Federica Sarro, Mark Harman*  
 Transactions on Software Engineering

TSE'21
- **Re-factoring Based Program Repair Applied to Programming Assignments**  
*Yang Hu, Umair Z. Ahmed, Sergey Mechtaev, Ben Leong, Abhik Roychoudhury*  
 International Conference on Automated Software Engineering 2019

ASE'19
- **Crash-Avoiding Program Repair**  
*Xiang Gao, Sergey Mechtaev, Abhik Roychoudhury*  
 International Symposium on Software Testing and Analysis 2019

ISSTA'19
- **Symbolic Execution with Existential Second-Order Constraints**  
*Sergey Mechtaev, Alberto Griggio, Alessandro Cimatti, Abhik Roychoudhury*  
 Symposium on the Foundations of Software Engineering 2018

FSE'18
- **Test-equivalence Analysis for Automatic Patch Generation**  
*Sergey Mechtaev, Xiang Gao, Shin Hwei Tan, Abhik Roychoudhury*  
 Transactions on Software Engineering and Methodology 2018

TOSEM'18
- **Semantic Program Repair Using a Reference Implementation**  
*Sergey Mechtaev, Manh-Dung Nguyen, Yannic Noller, Lars Grunske, Abhik Roychoudhury*  
 International Conference on Software Engineering 2018, Acceptance: 105/502 = 21%

ICSE'18
- **A Correlation Study Between Automated Program Repair and Test-suite Metrics**  
*Jooyong Yi, Shin Hwei Tan, Sergey Mechtaev, Marcel Boehme, Abhik Roychoudhury*  
 Empirical Software Engineering Journal 2017

EMSE'17
- **Codeflaws: A Programming Competition Benchmark for Evaluating Automated Program Repair Tools**  
*Shin Hwei Tan, Jooyong Yi, Yulis, Sergey Mechtaev, Abhik Roychoudhury*  
 International Conference on Software Engineering, Poster track 2017

ICSE'17-Poster
- **Angelix: Scalable Multiline Program Patch Synthesis via Symbolic Analysis**  
*Sergey Mechtaev, Jooyong Yi, Abhik Roychoudhury*  
 International Conference on Software Engineering 2016, Acceptance: 101/530 = 19%

ICSE'16
- **DirectFix: Looking for Simple Program Repairs**  
*Sergey Mechtaev, Jooyong Yi, Abhik Roychoudhury*  
 International Conference on Software Engineering 2015, Acceptance: 84/452 = 18%

ICSE'15
- **Eliminating Boilerplate Code in Objective Caml Programs**  
*Sergey Mechtaev*  
 System Programming 2011

Sprog'11
- **Efficiently Scrapping Boilerplate Code in OCaml**  
*Dmitri Boulytchev, Sergey Mechtaev*  
 Workshop on ML 2011

ML'11

## SELECTED PROJECTS

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**GitHub:** <https://github.com/mechtaev>

- **Modus:** Modus is a language for building Docker/OCI container images. Modus uses logic programming to express interactions among build parameters, specify complex build workflows, automatically parallelise and cache builds, help to reduce image size, and simplify maintenance. <https://modus-containers.com/>
- **Angelix:** the first constraint-based program repair system that scales to large real-world programs. Angelix generated a patch for the well-known Heartbleed vulnerability; it has been downloaded by researchers from over 60 institutions, and has been used in several projects including an intelligent tutoring system at IIT Kanpur. <http://angelix.io>
- **program-repair.org:** a community-driven website on program repair that was initiated and designed by me. Since its release, researchers from 7 institutions have contributed to this website; it has 200-300 unique visitors per month. <http://program-repair.org>

## PHD SUPERVISION

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- **Nikhil Parasaram (PhD)** University College London  
*First supervisor. Second supervisor: Earl T. Barr*  
Thesis: TBA  
September 2019–Present
- **Liu Yu (PhD)** National University of Singapore/CREST  
*Co-advisor. Other advisors: Abhik Roychoudhury, Emmanuel Letier*  
Thesis: TBA  
September 2020–Present

## TEACHING

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- **COMP0174 Practical Program Analysis** University College London  
*Module Leader*  
January 2023–March 2023
- **COMP0010 Software Engineering** University College London  
*Module Leader*  
September 2022–December 2022
- **COMP0174 Practical Program Analysis** University College London  
*Module Leader*  
January 2022–March 2022
- **COMP0010 Software Engineering** University College London  
*Module Leader*  
September 2021–December 2021
- **COMP0010 Software Engineering** University College London  
*Module Leader*  
September 2020–December 2020
- **COMP0010 Software Engineering** University College London  
*Module Leader*  
September 2019–December 2019
- **CS4218 Software Testing and Debugging** National University of Singapore  
*Teaching Assistant*  
January 2015–May 2015

## TALKS

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- **Modus: A Datalog Dialect for Building Container Images** Online  
*JetBrains Open Reading Club*  
December 2022
- **To Build is to Query: Building Container Images with Datalog** Online  
*Microsoft, MDCS Tech & Science Talks*  
November 2022
- **To Build is to Query: Building Container Images with Datalog** Singapore  
*National University of Singapore, CS Seminar*  
August 2022
- **Semantic Program Repair** Singapore (via video conferencing)  
*NUS Computing Research Week*  
August 2020

- **Synthesis of Software Patches Using Symbolic Execution** London, United Kingdom  
*62<sup>nd</sup> CREST Open Workshop on Program Repair and GI* January 2020
- **Automated Repair of Security Vulnerabilities** Tokyo, Japan  
*Shonan Meeting 160 on Fuzzing and Symbolic Execution* September 2019
- **Semantic Program Repair** Shenzhen, China  
*Southern University of Science and Technology* July 2019
- **Semantic Program Repair** London, United Kingdom  
*Imperial College London* May 2019
- **First-Order and Second-Order Symbolic Execution** Saint-Petersburg, Russia  
*JetBrains Research* April 2019
- **Semantic Program Repair** London, United Kingdom  
*University College London* July 2018
- **Semantic Program Repair Using a Reference Implementation** Schloss Dagstuhl, Germany  
*Dagstuhl Seminar 18151 on Program Equivalence* April 2018
- **Semantics-based Program Repair** Singapore  
*School of Computing, National University of Singapore* April 2017
- **Efficient Exploration of Patch Spaces for Automated Program Repair** Saint-Petersburg, Russia  
*JetBrains Research* March 2017
- **Towards a Synergy of Syntax-based and Semantics-based Program Repair** Schloss Dagstuhl, Germany  
*Dagstuhl Seminar 17022 on Automated Program Repair* January 2017
- **Constraint-based Automated Program Repair** Trento, Italy  
*Fondazione Bruno Kessler* May 2016

## SERVICE

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- **Organiser:**
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2023
  - International Conference on Software Engineering Student Research Competition (ICSE SRC) 2022
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2022
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2021
  - 62<sup>nd</sup> CREST Open Workshop (COW) on Automated Program Repair and Genetic Improvement 2020
  - International Workshop on Automated Program Repair (APR) co-located with ICSE 2020
- **Program committee:**
  - International Conference on Software Engineering (ICSE) 2024
  - Symposium on the Foundations of Software Engineering (FSE) 2023
  - International Conference on Automated Software Engineering (ASE) 2019, 2020, 2021
  - International Conference on Software Engineering Demonstrations (ICSE-Demo) 2022
  - Symposium on the Foundations of Software Engineering Doctoral Symposium (FSE-DS) 2022
  - International Conference on Automated Software Engineering Student Research Competition (ASE SRC) 2021
- **Reviewer:**
  - Transactions on Software Engineering (TSE) 2017, 2018, 2019, 2021, 2022
  - Empirical Software Engineering (EMSE) 2017, 2018, 2019, 2020, 2021, 2022
  - Transactions on Software Engineering and Methodology (TOSEM) 2018, 2019, 2020, 2021, 2022, 2023
  - Journal of Software: Evolution and Process 2022
  - Science of Computer Programming 2020

- Formal Method in System Design (FMSD) 2020
- **Subreviewer:**
  - International Conference on Automated Software Engineering (ASE) 2013
  - International Symposium on Software Testing and Analysis (ISSTA) 2015
  - International Conference on Software Testing, Verification, and Validation (ICST) 2017
  - Symposium on the Foundations of Software Engineering (FSE) 2017
  - International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS) 2019

## AWARDS

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- **IMDA Excellence Prize 2019** Singapore  
*National University of Singapore* 2019
- **Outstanding Doctoral Dissertation Award** Montreal, Canada  
*ACM SIGSOFT* 2019
- **Research Achievement Award** Singapore  
*National University of Singapore* 2016
- **NEERC Northern Subregional Programming Contest Honorable Mention** Saint Petersburg, Russia  
*ACM ICPC* 2007