

# Nadia Polikarpova

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## Research interests

My research interests are in *program synthesis*, *program verification*, and *developer tools*. My goal is to automate low-level aspects of programming, helping developers increase productivity and avoid mistakes.

## Research positions

<b>Assistant Professor</b> University of California, San Diego (La Jolla, CA)	Sep 2017–present
<b>Postdoctoral Associate</b> Massachusetts Institute of Technology (Cambridge, MA)	Dec 2014–Aug 2017
<b>Research Intern</b> Microsoft Research (Redmond, WA)	May–Aug 2011

## Education

<b>PhD, Computer Science</b> ETH Zurich (Switzerland)	Sept 2008–Jul 2014
<b>MSc, Applied Mathematics and Informatics</b> SPbSU ITMO (Saint-Petersburg, Russia)	Sept 2006–May 2008
<b>BSc, Applied Mathematics and Informatics</b> SPbSU ITMO (Saint-Petersburg, Russia)	Sept 2002–May 2006

## Awards

Intel Rising Stars Award, 2020.

Sloan Fellowship, 2020.

Rising Stars in EECS, 2016.

Distinguished Paper Awards: PLDI 2021, ICFP 2020, POPL 2019, Formal Methods 2015, Formal Methods 2011.

Distinguished Reviewer Awards: PLDI 2022, OOPSLA 2021.

ACM SIGSOFT Recognition of Services Award in appreciation for the contribution as a Deputy General Chair of ESEC/FSE 2013.

## Publications

- P35. D. Cao, R. Kunkel, C. Nandi, M. Willsey, Z. Tatlock, N. Polikarpova *babble: Learning Better Abstractions with E-Graphs and Anti-Unification*, ACM SIGPLAN Symposium on Principles of Programming Languages (**POPL**), 2023
- P34. J. Koppel, Z. Guo, E. de Vries, A. Solar-Lezama, N. Polikarpova *Searching Entangled Program Spaces*, ACM SIGPLAN International Conference on Functional Programming (**ICFP**), 2022

- P33. Z. Guo, D. Cao, D. Tjong, J. Yang, C. Schlesinger, N. Polikarpova *Type-Directed Program Synthesis for RESTful APIs*, ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2022
- P32. K. Ferdowsifard, S. Barke, H. Peleg, S. Lerner, N. Polikarpova *LooPy: Interactive Program Synthesis with Control Structures*, ACM SIGPLAN conference on Systems, Programming, Languages, and Applications: Software for Humanity (SPLASH/OOPSLA), 2021
- P31. Y. Watanabe, K. Gopinathan, G. Pirlea, N. Polikarpova, I. Sergey *Certifying the Synthesis of Heap-Manipulating Programs*, ACM SIGPLAN International Conference on Functional Programming (ICFP), 2021
- P30. D. Lukes, J. Sarracino, C. Coleman, H. Peleg, S. Lerner, N. Polikarpova *Synthesis of Web Layouts from Examples*, The ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE), 2021
- P29. S. Itzhaky, H. Peleg, N. Polikarpova, R. Rowe, I. Sergey *Deductive Synthesis of Programs with Pointers: Techniques, Challenges, Opportunities (Invited Paper)*, International Conference on Computer-Aided Verification (CAV), 2021
- P28. N. Lehmann, R. Kunkel, J. Brown, J. Yang, N. Vazou, N. Polikarpova, D. Stefan, R. Jhala *STORM: Refinement Types for Secure Web Applications*, USENIX Symposium on Operating Systems Design and Implementation (OSDI), 2021
- P27. S. Itzhaky, H. Peleg, N. Polikarpova, R. Rowe, I. Sergey *Cyclic Program Synthesis*, ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI), 2021, **distinguished paper award**
- P26. H. Wang, N. Polikarpova, J. Fan *Learning part-based abstractions for visual object concepts*, Annual Meeting of the Cognitive Science Society (CogSci), 2021
- P25. H. Wang, E. Vul, N. Polikarpova, J. Fan *Theory acquisition as constraint-based program synthesis*, Annual Meeting of the Cognitive Science Society (CogSci), 2021
- P24. S. Barke, H. Peleg, N. Polikarpova *Just-in-Time Learning for Bottom-Up Enumerative Synthesis*, ACM SIGPLAN conference on Systems, Programming, Languages, and Applications: Software for Humanity (SPLASH/OOPSLA), 2020
- P23. M. B. James, Z. Guo, Z. Wang, S. Doshi, H. Peleg, R. Jhala, N. Polikarpova *Digging for Fold: Synthesis-Aided API Discovery for Haskell*, ACM SIGPLAN conference on Systems, Programming, Languages, and Applications: Software for Humanity (SPLASH/OOPSLA), 2020
- P22. K. Ferdowsifard, A. Ordookhanians, H. Peleg, S. Lerner, N. Polikarpova *Small-Step Live Programming by Example*, ACM Symposium on User Interface Software and Technology (UIST), 2020
- P21. N. Polikarpova, D. Stefan, J. Yang, S. Itzhaky, T. Hance, A. Solar-Lezama *Liquid Information Flow Control*. ACM SIGPLAN International Conference on Functional Programming (ICFP), 2020, **distinguished paper award**
- P20. T. Knoth, A. Reynolds, D. Wang, N. Polikarpova, J. Hoffman *Liquid Resource Types*. ACM SIGPLAN International Conference on Functional Programming (ICFP), 2020
- P19. H. Peleg, N. Polikarpova *Perfect is the Enemy of Good: Best-Effort Program Synthesis*. European Conference on Object-Oriented Programming (ECOOP), 2020
- P18. A. Costea, A. Zhu, N. Polikarpova, I. Sergey *Concise Read-Only Specifications for Better Synthesis of Programs with Pointers*. European Symposium on Programming (ESOP), 2020
- P17. Z. Guo, M. B. James, D. Justo, J. Zhou, Z. Wang, R. Jhala, N. Polikarpova *Program Synthesis by Type-Guided Abstraction Refinement*. ACM SIGPLAN Symposium on Principles of Programming Languages (POPL), 2020

- P16. S. Barke, R. Kunkel, E. Meinhardt, N. Polikarpova, Eric Baković, L. Bergen. *Constraint-based learning of phonological processes*. Empirical Methods in Natural Language Processing (**EMNLP**), 2019
- P15. T. Knoth, D. Wang, N. Polikarpova, J. Hoffman. *Resource-Guided Program Synthesis*. ACM SIGPLAN Conference on Programming Language Design and Implementation (**PLDI**), 2019
- P14. N. Polikarpova, I. Sergey. *Structuring the Synthesis of Heap-Manipulating Programs*. ACM SIGPLAN Symposium on Principles of Programming Languages (**POPL**), 2019, **distinguished paper award**
- P13. S. Anand, N. Polikarpova. *Automatic Synchronization for GPU Kernels*. Formal Methods in Computer-Aided Design (**FMCAD**), 2018
- P12. J. P. Inala, N. Polikarpova, X. Qiu, B. S. Lerner, and A. Solar-Lezama. *Synthesis of Recursive ADT Transformations*. International Conference on Tools and Algorithms for the Construction and Analysis of Systems (**TACAS**), 2017
- P11. N. Polikarpova, I. Kuraj, and A. Solar-Lezama. *Program synthesis from polymorphic refinement types*. ACM SIGPLAN Conference on Programming Language Design and Implementation (**PLDI**), 2016
- P10. N. Polikarpova, J. Tschannen, and C. A. Furia. *A Fully Verified Container Library*. International Symposium on Formal Methods (**FM**), 2015, **best paper award**
- P9. J. Tschannen, C. A. Furia, M. Nordio, and N. Polikarpova. *AutoProof: Auto-active Functional Verification of Object-oriented Programs*. International Conference on Tools and Algorithms for the Construction and Analysis of Systems (**TACAS**), 2015
- P8. N. Polikarpova, J. Tschannen, C. A. Furia, and B. Meyer. *Flexible Invariants Through Semantic Collaboration*. International Symposium on Formal Methods (**FM**), 2014
- P7. N. Polikarpova, C. A. Furia, and S. West. *To Run What No One Has Run Before*. International Conference on Runtime Verification (**RV**), 2013
- P6. N. Polikarpova, C. A. Furia, Y. Pei, Y. Wei, and B. Meyer. *What Good Are Strong Specifications?* International Conference on Software Engineering (**ICSE**), 2013
- P5. K. R. M. Leino and N. Polikarpova. *Verified calculations*, Verified Software: Theories, Tools and Experiments (**VSTTE**), 2013
- P4. N. Polikarpova N and M. Moskal. *Verifying implementations of security protocols by refinement*. Verified Software: Theories, Tools and Experiments (**VSTTE**), 2012
- P3. P. Müller, N. Shankar, G. T. Leavens, T. Ridge, T. Tuerk, V. Klebanov, M. Ulbrich, B. Weiß, K. R. M. Leino, R. Chapman, R. Monahan, N. Polikarpova, D. Bronish, R. Arthan, E. Alkassar, E. Cohen, M. Hillebrand, S. Tobies, B. Jacobs, F. Piessens, and J. Smans. *The 1st Verified Software Competition: Experience Report*. International Symposium on Formal Methods (**FM**), 2011, **best paper award**
- P2. N. Polikarpova, C. Furia, and B. Meyer. *Specifying Reusable Components*. Verified Software: Theories, Tools and Experiments (**VSTTE**), 2010
- P1. N. Polikarpova, I. Ciupa, and B. Meyer. *A comparative study of programmer-written and automatically inferred contracts*. International Conference on Software Testing and Analysis (**ISSTA**), 2009

## Books

- B1. N. Polikarpova and A. Shalyto. *Automata-based Programming* (in Russian). Piter, 2009

## Teaching

### Instructor

Programming Languages (UCSD, undergraduate)	Sp'18, Wi'19, Fa'19, Sp'20, Fa'20, Sp'21, Fa'21, Sp'22
Programming Languages (UCSD, graduate)	Fa'22
Program Synthesis (UCSD, graduate)	Fa'17, Fa'18, Wi'20, Wi'21, Wi'22, Wi'23

### Teaching assistant

Java and C# in depth (ETH Zurich)	2010, 2014
Introduction to Programming (ETH Zurich)	2008–2013
Software Architecture (ETH Zurich)	2009

### Guest Lecturer

Program verification and synthesis (Univ. of Wisconsin-Madison)	2020
Foundations of Program Analysis (MIT)	2015
Software Verification (ETH Zurich)	2009–2013
Software Architecture (ETH Zurich)	2011
Eiffel: Analysis, Design and Programming (ETH Zurich)	2009

## Advising

### Current advisees:

Kasra Ferdowsi (PhD, co-advised with Sorin Lerner)  
 Zheng Guo (PhD)  
 Rose Kunkel (PhD)  
 Shraddha Barke (PhD)  
 Michael James (PhD)  
 Tristan Knoth (PhD)

### Former advisees:

Hila Peleg (Postdoc, 2019-2021; now faculty at the Technion)  
 John Sarracino (PhD thesis, UCSD, 2020, co-advised with Sorin Lerner; now postdoc at Cornell)  
 David Justo (Master's thesis, UCSD, 2019)  
 Sourav Anand (Master's thesis, UCSD, 2019)

## Selected Talks

- T17. *Tutorial on Deductive Program Synthesis*. Summer school on Neurosymbolic Programming, CalTech, July 2022
- T16. *Learning Better Abstractions with E-Graphs and Anti-Unification*. IFIP WG 2.8 meeting, Cornell Tech, May 2022
- T15. *Generating Programs from Types*. Haskell eXchange, November 2021
- T14. *Synthesis of Safe Pointer-Manipulating Programs*. Workshop on Dependable and Secure Software Systems, ETH Zurich, October 2021

- T13. *SuSLik: Synthesis of Safe Pointer-Manipulating Programs (Tutorial)*. CAV'21, July 2021
- T12. *Synthesis of Safe Pointer-Manipulating Programs (Keynote)*. LICS/ITP'21, July 2021
- T11. *Synthesis of Safe Pointer-Manipulating Programs*. Isaac Newton Institute Workshop on Verified Software: Tools and Experiments, June 2021
- T10. *Liquid Information Flow Control*. IFIP WG 2.8 meeting, February 2021
- T9. *Generating Programs from Types*. Lambda Days, February 2021
- T8. *Generating Programs from Types (Keynote)*. APLAS'20, December 2020
- T7. *Program Synthesis*. PL+HCI "Swimmer" School, August 2020
- T6. *Liquid Resource Types for Verification and Synthesis*. Chalmers Seminar on Functional Programming, May 2020
- T5. *Liquid Resource Types for Verification and Synthesis*. IFIP WG 2.8 meeting, Zion, March 2020
- T4. *SuSLik: Synthesis of Safe Pointer-Manipulating Programs (Keynote)*. ADSL'20, New Orleans, January 2020
- T3. *Synthesizing Programs from Types (Tutorial)*. POPL'20, New Orleans, January 2020
- T2. *SuSLik: Synthesis of Safe Pointer-Manipulating Programs (Tutorial)*. FMCAD'19, San Jose, October 2019
- T1. *Type-Driven Program Synthesis*. Strangeloop, September 2018

## Professional Membership and Service

**Chair** of SIGPLAN-M, the SIGPLAN Long-Term Mentoring Committee (Dec 2022–present)

**Program (co-)Chair:** Haskell'22, VSTTE'20, iFM'17

**Program Committee member:** OOPSLA'23, POPL'23, PLDI'22, ASL'22, EGRAPHS'22, OOPSLA'21, POPL'21, ICFP'20, VMCAI'20, ADSL'20, PLDI'19, SecDev'19, HCVS'19, iFM'19, Haskell'19, OOPSLA'18, POPL'18, SYNT'18, CAV'17, APLAS'16, FTfJP'16, SYNT'16, VSTTE'16, TAP'16, iFM'16, FESCA'16, VMCAI'16, PSI'15, FTfJP'15, FESCA'15, RV'14, FESCA'14

**Journal reviewer:** ACM Transactions on Programming Languages and Systems, Journal of Functional Programming, Formal Aspect of Computing

**Co-organizer:** PLDI'22 (Workshops and Tutorials co-chair); Programming Languages Mentoring Workshop at PLDI'21, PLDI'20, and POPL'18; ESEC/FSE'13 (deputy general chair)

**Member:** ACM SIGPLAN, IFIP WG2.8 (Functional Programming)