Dr. Elizabeth Polgreen

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Education

2016 – 2020	**PhD**, *Computer Science*, The University of Oxford.
2010 – 2011	**Masters of Engineering**, *Electrical and Electronic Engineering*, The University of Cambridge.
2007 – 2010	**Bachelor of Arts**, *Electrical and Electronic Engineering*, The University of Cambridge.

Employment

2020 –	**Lecturer**, *Laboratory for Foundations of Computer Science*, University of Edinburgh. My research interests are in program synthesis algorithms, applications of program synthesis and integration of synthesis into verification techniques.
2019 – 2020	**Visiting Research Scholar**, *Computer Science*, The University of California, Berkeley.
Jun 2018 – Sep 2018	**Software Development Intern**, *Amazon Web Services, Dresden*. Applying formal verification techniques to C code for an x86 hypervisor
Aug 2017 – Oct 2017	**Software Development Intern**, *Amazon Web Services, Dresden*. Development of analysis tools based on formal methods for hot-patching an x86 hypervisor
Sep 2015 – Mar 2016	**Research Assistant in Verification**, *Department of Computer Science, University of Oxford*. Working with Professor Alessandro Abate on application of machine learning techniques in verification.
Sep 2013 – Aug 2015	**Research Support**, *Department of Computer Science, University of Oxford*. Lead aspects of research project execution over a broad variety of research projects within the Systems Verification and Validation group.
Jan 2013 – Aug 2013	**Electronics and Software Engineer**, *Peach Innovations*, Cambridge. Manufacture, testing and debugging of real-time rowing instrumentation systems. Analysis of system output data with view to new product development.
Aug 2011 – Jan 2013	**Electronics and Software Engineer**, *Eg Technology*, Cambridge. Design engineer developing electronics hardware and software for a variety of consumer and medical devices. Main contributor of C code to embedded software projects using ARM microcontrollers. Further experience in LabVIEW, and contributing to larger team projects written in C#.

Peer-reviewed Publications

2023	**C2TACO: Lifting Tensor Code to TACO**, *José' Wesley De Souza Magalhães, Jackson Woodruff, Elizabeth Polgreen, Michael F. P. O'Boyle*, GPCE.
2023	**Message Chains for Distributed Systems Verification**, *Federico Mora, Ankush Desai, Elizabeth Polgreen, Sanjit A. Seshia*, OOPSLA.
2023	**mlirSynth: Automatic, Retargetable Program Raising in Multi-Level IR using Program Synthesis** , *Alexander Brauckmann, Elizabeth Polgreen, Tobias Grosser, Michael O'Boyle* , PACT.
2023	**Towards Building Verifiable CPS using Lingua Franca**, *Shaokai Lin, Yatin A. Manerkar, Marten Lohstroh, Elizabeth Polgreen, Sheng-Jung Yu, Chadlia Jerad, Edward Lee, Sanjit A. Seshia*, EMSOFT.

2023 **Synthesising Programs with Non-trivial Constants**, *Alessandro Abate, Haniel Barbosa, Clark Barrett, Cristina David, Pascal Kesseli, Daniel Kroening, Elizabeth Polgreen, Andrew Reynolds, Cesare Tinelli* , Journal of Automated Reasoning.

2022 **UCLID5: Multi-Modal Formal Modeling, Verification, and Synthesis**, *Elizabeth Polgreen, K. Cheang, Pranav Gaddamadugu, Adwait Godbole, Kevin Laeufer, Shaokai Lin, Yatin Manerkar, Federico Mora, Sanjit A. Seshia*, Computer Aided Verification (CAV).

2022 **Synthesis and Satisfiability Modulo Oracles**, *Elizabeth Polgreen, A. Reynolds, Sanjit A. Seshia*, International Conference on Verification, Model Checking, and Abstract Interpretation(VMCAI).

2021 **The SyGuS Language Standard Version 2.1**, *Saswat Padhi, Elizabeth Polgreen, Mukhund Raghothaman, Andrew Reynolds, Abishek Udupa*.

2021 **Medley Solver: Online SMT Algorithm Selection**, *N. Pimpalkhare, F. Mora, Elizabeth Polgreen, Sanjit A. Seshia*, International Conference on Satisfiability (SAT).

2020 **Using model checking tools to triage the severity of security bugs in the Xen hypervisor**, *Byron Cook, Bjoern Doebel, Daniel Kroening, Norbert Manthey, Martin Pohlack, Elizabeth Polgreen, Michael Tautschnig, Pawel Wieczorkiewicz* , Formal Methods in Computer-Aided Design (FMCAD).

2020 **Automated Formal Synthesis of Digital Controllers for State-Space Physical Plants**, *Alessandro Abate, Iury Bessa, Dario Cattaruzza, Lucas Cordeiro, Cristina David, Pascal Kesseli, Daniel Kroening, and Elizabeth Polgreen*, Acta Informatica, `https://doi.org/10.1007/s00236-019-00359-1`.

2020 **Gradient Descent over Metagrammars for Syntax-Guided Synthesis**, *N. Chan, Elizabeth Polgreen, Sanjit A. Seshia*, Workshop of Synthesis (SYNT).

2020 **Synthesis in UCLID5**, *Federico Mora, Kevin Chan, Elizabeth Polgreen, Sanjit A. Seshia*, Workshop of Synthesis (SYNT).

2018 **CounterExample Guided Inductive Synthesis Modulo Theories**, *Alessandro Abate, Cristina David, Pascal Kesseli, Daniel Kroening, Elizabeth Polgreen*, Computer Aided Verification (CAV).

2017 **Automated Formal Synthesis of Digital Controllers for State-Space Physical Plants**, *Alessandro Abate, Iury Bessa, Dario Cattaruzza, Lucas Cordeiro, Cristina David, Pascal Kesseli, Daniel Kroening, and Elizabeth Polgreen*, Computer Aided Verification (CAV).

2017 **DSSynth: An Automated Digital Controller Synthesis Tool for Physical Plants**, *Alessandro Abate, Iury Bessa, Dario Cattaruzza, Lennon Chaves, Lucas Cordeiro, Cristina David, Pascal Kesseli, Daniel Kroening, and Elizabeth Polgreen*, Automated Software Engineering (ASM).

2017 **Automated Experiment Design for Efficient Verification of Parametric Markov Decision Processes**, *Elizabeth Polgreen, Vijay Wijesuriya, Sofie Hasaert, Alessandro Abate*, Quantitative Evaluation of SysTems (QEST).

2016 **Data-efficient Bayesian Verification of Parametric Markov Chains**, *Elizabeth Polgreen, Vijay Wijesuriya, Sofie Haesaert, Alessandro Abate*, Quantitative Evaluation of SysTems (QEST).

Under Submission

2023 **Reinforcement Learning for Syntax-Guided Synthesis**.

Arxiv

SynRG: Syntax Guided Synthesis of Invariants with Alternating Quantifiers., *Elizabeth Polgreen, Sanjit A. Seshia.*

Verifying Reachability Properties in Markov Chains via Incremental Induction., *Elizabeth Polgreen, Martin Brain, Martin Fraenzle, Alessandro Abate.*

CounterExample Guided Neural Synthesis, *Elizabeth Polgreen, Ralph Abboud, Daniel Kroening.*

Invited Talks

2023 **Sherlock Holmes and the Case of the Untrustworthy Software**, TedX University of Edinburgh.

2022 **Beyond Counterexamples: Synthesis Modulo Oracles**, 11th Workshop on Synthesis.

2022 **UCLID5: multi-modal modeling, synthesis and verification**, 3rd Workshop on Democratizing Software Verification.

2022 **Model checking Xen**, Verified Software Workshop, Isaac Newton Institute for Mathematical Sciences.

2021 **CounterExample Guided Inductive Synthesis Modulo Theories**, The Simons Institute for the Theory of Computing.

Service

Seminar Co-Organiser, *Dagstuhl*, The Future of Reactive Synthesis, September 2023.

Journal Editor, *FMSD*, Special Edition on Synthesis, 2024.

Steering committee, ETAPS, 2022-onwards.

Workshop chair, International Workshop on Synthesis (SYNT), 2021.

Program committees.
2024: CAV, TACAS
2023: CAV, SYNT, PriSC, DAV
2022: SMT workshop, SAT, CAV, FMCAD, QEST
2021: CAV (artefact evaluation), TACAS (artefact evaluation), FMCAD, QEST
2019: International Workshop on Synthesis (SYNT)

Non-program committee reviews.
Acta Informatica, Transactions on Programming Languages and Systems, Robotics: Science and Systems 2017, CAV 2021, SOFSEM-FOCS2017, QEST 2017, QEST 2016, Information and Software Technology, 13th International Workshop on Discrete Event Systems

Research Grants

2023 **Royal Academy of Engineering Research Fellowship**, 5 years.

2023 **Amazon Research Award**, 1 year.

Teaching

2024 **System Design Project**, *University of Edinburgh*, Lecturer.

2023 **System Design Project**, *University of Edinburgh*, Lecturer.

2022 **Introduction to SAT/SMT**, *Scottish Programming Languages and Verification Summer School*, Lecturer.

2021 **Formal Verification**, *University of Edinburgh*, Course organiser.

2022 **Reasoning and Agents**, *University of Edinburgh*, Tutorials.

2021 **Discrete Maths and Probability**, *University of Edinburgh*, Tutorials.

2020 **Formal Methods: Specification, Verification, and Synthesis**, *UC Berkeley*, Guest Lectures.

2018 **Computer Aided Verification Course**, *University of Oxford*, Guest Lecture.

2020 **Outreach Volunteer**, *Lawrence Hall of Science, UC Berkeley*.

Students

2022-present **Advances and applications of synthesis**, *Yixuan Li*, PhD candidate, Universty of Edinburgh.
Primary supervisor

2022-present **Verified Lifting**, *José Wesley De Souza Magalhães* , PhD candidate, Universty of Edinburgh.
Second supervisor