Markus de Medeiros

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Education

New York University, Courant Institute — New York, NY
PhD in Computer Science, in progress. — *September 2023 – Present*

University of British Columbia — Vancouver, BC
BSc Combined Honours in Computer Science and Mathematics. *GPA: 3.8/4.0* *September 2018 – April 2023*

- Stanley M. Grant Scholarship in Mathematics: 2022. By recommendation of the department.
- Dean's Honour List: 2018-2023; NSERC USRA award: 2021; UBC SURE award: 2022, 2023.

Experience

Applications of Higher-Order Separation Logic in Probabilistic Verification — September 2023 – Present
with Joseph Tassarotti (NYU)

- Verifying safety and privacy properties of distributed systems with Coq.
- Proving new properties about probabilistic algorithms by applying recent extensions to the Clutch program logic.

Coupled Borrows: Automated, Extensible Memory Safety Proofs for Prusti — May 2022 – Present
with Alex Summers (UBC), Aurel Bílý (ETH Zurich)

- Designed an interface to the internal state of the Rust borrow checker for use by automated verification tools.
- Enabled previously unsupported reasoning about lifetimes with complex dataflow and type constraints in Prusti.
- Contributed to the ongoing stabilization effort for Rust's intermediate semantics.
- **Presented** a synopsis of our new approach for Rust verification researchers (slides available).
- Wrote about our model: **Publication in progress**, *BSc. thesis available on request.*

Fractional Reaction-Diffusion Systems — May 2021 – August 2021
with Jun-cheng Wei (UBC)

- Validated and directed the development of our asymptotic theory using new simulations for fractional PDE's.
- **Published** Existence and stability of symmetric and asymmetric patterns for the half-laplacian gierer–meinhardt system in one-dimensional domain. *Mathematical Models and Methods in Applied Sciences (2022)*. DOI.
- **Preprint** Spike Solutions to the Supercritical Fractional Gierer-Meinhardt System. DOI.

Leadership

Pirate 311 — September 2022 – November 2022

- Organized an unoffical seminar in response to the cancellation UBCs official programming languages course.
- Provided resources and networking for programming languages students by leading regular group discussions.

Undergraduate Teaching Assistant

- CPSC 312 (Functional & Logic Programming), CPSC 421 (Theory of Computation), CPSC 310 (Software Engineering), MATH 184 (Differential Calculus).
- Mentored students through team scrum meetings, individual office hours, and coursewide review sessions.

Projects

Prusti | *Rust* — Present

- Iterated on several research prototypes to continually evaluate our theory with concrete use cases.
- Simplified Prusti's architecture using new abstractions designed to efficiently reuse compiler information.
- Evaluated properties of our model using a compiler plugin to test mutants of Rust's internal control flow graphs.

Fine | *Haskell*	*experiment in combining refinement types and abstract interpretation*	April 2023
Unify | *Rust*	*a generic, rewrite-free unification engine*	May 2022
Lucid | *Haskell*	*spectrogram music visualizer*	March 2022
GrobnerCAD | *Java*	*2D CAD frontend for polynomial-based geometric constraint solving*	March 2020

Technical Skills

Languages: Rust, Coq, OCaml, Haskell, Python, C/C++, Prolog, Java, TypeScript
Verification Tools: Iris, Prusti, Viper, Z3
Research Interests: Automated reasoning, separation logic, distributed and concurrent verification, functional programming, type systems, algebra, verified compilation, systems, security.