Jonathan Van der Cruysse

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SUMMARY

Compiler engineer specializing in optimizations, IR design, and equality saturation. Experienced building compiler infrastructure in Scala, C#, C++, LLVM and MLIR ecosystems. Research published at CGO and CC on compiler optimizations for hardware mapping and resource sharing for machine learning programs.

EDUCATION

PhD, Computer Science, McGill University 2020–2026 (expected)

- Supervisor: Prof. Christophe Dubach • cGPA: 4.0/4.0 • Passed defense, graduating May 2026
- Thesis: *Cross-Abstraction Equality Saturation for Idiom Recognition and Hardware Sharing*
- Doctoral Research Scholarship, Fonds de Recherche du Québec – Nature et Technologies (2021–2025)
- Presented research at CGO 2026, CGO 2024, CC 2026, CDP 2022 and CDP 2024
- VP Academic (2023–2024) and VP Financial (2024–2025), McGill Computer Science Graduate Society

MSc, Computer Science Engineering, Ghent University 2017–2019

- Thesis: *Garbage Collection Abstractions for High-Level GPU*
- Summa cum laude (highest academic distinction)

BSc, Computer Science, University of Antwerp 2014–2017

- Summa cum laude (highest academic distinction)
- Erasmus Exchange, University of Edinburgh (Fall 2016, mean score: 90%)

TECHNICAL SKILLS

Languages: Scala, C++, Python, OCaml, C#, F#, TypeScript
Compiler technology: SSA IRs, equality saturation, rewrite systems, optimization passes
Performance engineering: benchmarking, profiling, optimization search
Toolchains: LLVM, MLIR, .NET, WebAssembly

EXPERIENCE

Teaching Assistant, McGill University 2020–2026

- Supported hundreds of students across compiler, programming languages, and systems courses
- Designed and delivered labs on IRs, optimization passes, and low-level execution
- Mentored teams on multi-week projects, emphasizing technical communication

Research Intern, Nokia Bell Labs Summer 2018

- Developed domain-specific optimizations for XStream, a TypeScript-based stream processing language
- Designed a low-overhead (3% run-time overhead vs. 76% for prior state-of-the-art tool) JavaScript/TypeScript instrumentation technique for closure serialization, leading to a publication
- Presented resulting work (FlashFreeze) at META 2019 in Athens

Teaching & Curriculum Development Assistant, University of Antwerp 2015–2016

- Authored C++ programs to demonstrate advanced programming idioms
- Built tooling to generate exercises and exams on regular languages and automata

PROJECTS

Foresight – Parallel Equality Saturation Engine jonathanvdc/foresight

- Parallel equality saturation engine enabling 16× speedups for program optimization
- Built parallel rewrite execution and programmable saturation strategies
- Reimplemented multiple published techniques on top of the system

Flame – Compiler Framework for Managed Languages jonathanvdc/flame

- Built an SSA-based ahead-of-time compiler for .NET and JVM bytecode
- Translates managed-language programs to LLVM IR and WebAssembly for optimized native execution
- Implemented front-ends, back-ends (LLVM, WebAssembly), and whole-program optimization pipeline

MLIR.NET – Typed MLIR Infrastructure for .NET jonathanvdc/mlir.net

- Designed a strongly-typed C# representation of MLIR, modeling operands, attributes, regions, and types
- Reconstructed MLIR's ODS to generate dialect-specific C# types, parsers, and printers from TableGen
- Developed layered concrete and abstract representations enabling syntax-preserving IR manipulation

PUBLICATIONS

CGO'26 **Jonathan Van der Cruysse**, Tzung-Han Juang, Shakiba Bolbolian Khah, Christophe Dubach. *SkeleShare: Algorithmic Skeletons and Equality Saturation for Hardware Resource Sharing*. IEEE/ACM International Symposium on Code Generation and Optimization (CGO), 2026.

Artifact Available Artifact Reusable Results Reproduced

- Automates FPGA resource allocation and sharing using equality saturation and algorithmic skeletons; matches or exceeds expert manual designs on neural network and image-processing workloads.

CC'26 **Jonathan Van der Cruysse**, Abd-El-Aziz Zayed, Jacob Mai Peng, Christophe Dubach. *Parallel and Customizable Equality Saturation*. ACM SIGPLAN International Conference on Compiler Construction (CC), 2026. Artifact Available Artifact Reusable Results Reproduced

- Introduces Foresight, a parallel and customizable equality saturation engine; demonstrates 16× speedup over existing approach for idiom recognition and enables new optimizations.

CGO'24 **Jonathan Van der Cruysse**, Christophe Dubach. *Latent Idiom Recognition using Equality Saturation*. IEEE/ACM International Symposium on Code Generation and Optimization (CGO), 2024.

Artifact Available Artifact Reusable Results Reproduced

- Recognizes BLAS and PyTorch idioms using a minimalist functional array language and equality saturation; generates implementations achieving 1.46× geometric mean speedup over reference C kernels.

META'19 **Jonathan Van der Cruysse**, Lode Hoste, Wolfgang Van Raemdonck. *FlashFreeze: Low-Overhead JavaScript Instrumentation for Function Serialization*. ACM SIGPLAN International Workshop on Meta-Programming Techniques and Reflection (META), 2019.

- Capture-list-based JavaScript instrumentation enabling function serialization with only 3% runtime overhead vs. 76% for prior state-of-the-art tool.

LANGUAGES

English (native-level), French (working proficiency), Dutch (native), Spanish (intermediate)