Raphaël Monat

Permanent researcher at Inria, Lille, France

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Education

Grades from 0 to 20 (best). GPA above 16 are equivalent to highest honors.

PhD under the supervision of Antoine Miné — LIP6, Sorbonne Université, France

Static Type and Value Analysis by Abstract Interpretation of Python Programs with Native C Libraries. — September 2018 – November 2021

	Antoine Miné	Sorbonne Université, France	Advisor
	Isabella Mastroeni	Università di Verona, Italy	Reviewer
	Anders Møller	Aarhus Universitet, Denmark	Reviewer
Thesis committee :	Emmanuel Chailloux	Sorbonne Université, France	Examiner
	Francesco Logozzo	Facebook Seattle, USA	Examiner
	Peter Müller	ETH Zürich, Switzerland	Examiner
	Alan Schmitt	Inria Rennes, France	Examiner

Master 2 Parisian Master in Computer Science — Université Paris Diderot, France

GPA 16.81/20 — 2017-2018

Master 2 Fundamental Computer Science — ENS de Lyon, France

GPA 16.49/20 — 2016–2017

Master 1 Fundamental Computer Science — ENS de Lyon, France

GPA 16.36/20 — 2015–2016

Bachelor in Fundamental Computer Science — ENS de Lyon, France

GPA 16.43/20 — 2014–2015

4-year Scholarship Awarded for Studying Computer Science — ENS de Lyon, France

2014

Two-year Intensive Training in Maths, Physics and Computer Science — Lycée Louis-le-Grand, France

“Classes préparatoires MPSI/MP* option informatique” — 2012–2014

Baccalauréat Scientifique, with highest honors — Lycée Aristide Bergès, France

2012

Professional experiences

Permanent researcher — Inria @ University of Lille

SyCoMoRES team — Since September 2022

Temporary teaching and research assistant — LIP6, Sorbonne Université, France

Research in collaboration with Antoine Miné. Teaching duties in computer science (192h). — September 2021 - August 2022

Contractual PhD student with teaching duties — LIP6, Sorbonne Université, France

PhD under the supervision of Antoine Miné. Teaching duties in computer science (64h/year). — September 2018 – November 2021

Master 2 internship under the supervision of Antoine Miné — LIP6, Sorbonne Université, France

Static type analysis of python programs. — March – June 2018

Master 2 internship under the supervision of Eva Darulova — MPI-SWS, Saarbrücken, Germany

Extending Coq and HOL4 formalizations of Daisy, a synthetizer of numerical programs. — February – June 2017

Master 1 internship under the supervision of Hongseok Yang — Oxford, United Kingdom

Variational inference for probabilistic programming languages. — May – July 2016

Bachelor internship under the supervision of Antoine Miné — Antique, ENS Ulm, France

Static analysis of concurrent programs with a sequentially consistent memory. — June – July 2015

Publications

Title in black: main author (gray otherwise). Badges for artefacts: (ACM), (others). double-column article (otherwise), tool paper. Clickable titles, events and artefact badges.

International Conferences with Peer Review

A Multilanguage Static Analysis of Python Programs with Native C Extensions — SAS 2021
Raphaël Monat, *Abdelraouf Ouadjaout, Antoine Miné* — 23 pages

A Modern Compiler for the French Tax Code — CC 2021
Denis Merigoux, Raphaël Monat, *Jonathan Protzenko* — 11 pages

Static Type Analysis by Abstract Interpretation of Python Programs — ECOOP 2020
Raphaël Monat, *Abdelraouf Ouadjaout, Antoine Miné* — 27 pages

Combinations of reusable abstract domains for a multilingual static analyzer (Invited) — VSTTE 2019
Matthieu Journault, Antoine Miné, Raphaël Monat, *Abdelraouf Ouadjaout* — 16 pages

A Verified Certificate Checker for Finite-Precision Error Bounds in Coq and HOL4 — FMCAD 2018
Heiko Becker, Nikita Zyuzin, Raphaël Monat, *Eva Darulova, Magnus O. Myreen, Anthony Fox* — 8 pages

Precise Thread-Modular Abstract Interpretation of Concurrent Programs using Relational Interference Abstractions — VMCAI 2017
Raphaël Monat, *Antoine Miné* — 17 pages

International Workshops with Peer Review

Value and Allocation Sensitivity in Static Python Analyses — SOAP 2020
Raphaël Monat, *Abdelraouf Ouadjaout, Antoine Miné* — 6 pages

National Conferences with Peer Review

Mlang: an Open-Source Toolchain for the Income Tax Computation — JFLA 2021
Denis Merigoux, Raphaël Monat — 2 pages

Démonstration de la plateforme Mopsa d'analyse statique de programmes par interprétation abstraite — JFLA 2021
Matthieu Journault, Antoine Miné, Raphaël Monat, *Antoine Miné* — 2 pages

Étude formelle de l'implémentation du code des impôts — JFLA 2020
Denis Merigoux, Raphaël Monat, *Christophe Gaie* — 16 pages

Manuscript and Technical Reports

Static Type and Value Analysis by Abstract Interpretation of Python Programs with Native C Libraries — Thesis (2021)
Raphaël Monat — 275 pages

Static Analysis by Abstract Interpretation Collecting Types of Python Programs — Internship report (M2, 2018)
Raphaël Monat — 20 pages

Certificate Checking in Coq and HOL4 for Static Analyses of Mixed-Precision Floating-Point Arithmetic — Internship report (M2, 2017)
Raphaël Monat — 24 pages

Variational Inference in Probabilistic Programs: formal derivation of a black-box approach — Internship report (M1, 2016)
Raphaël Monat — 26 pages

Thread-Modular Analysis designing relational abstractions of interferences — Internship report (L3, 2015)
Raphaël Monat — 21 pages

Talks

Duration of the talks without question time. Clickable links.

Invited talk

01/12/21 **A Multilanguage Static Analysis of Python/C Programs with Mopsa**, 25 minutes **Facebook TAV**

"Testing and Verification (TAV) Symposium brings together academia and industry in an open environment to exchange ideas and *showcase the top experts from testing and verification scientific research and practice*." (link)

Talks in conferences

18/10/21 **A Multilanguage Static Analysis of Python Programs with Native C Extensions**, 15 minutes SAS
07/04/21 **Mlang: an Open-Source Toolchain for the Income Tax Computation**, 15 minutes JFLA
03/03/21 **A Modern Compiler for the French Tax Code**, 12 minutes CC
15/11/20 **Static Type Analysis by Abstract Interpretation of Python Programs**, 15 minutes ECOOP
15/06/20 **Value and Allocation Sensitivity in Static Python Analyses**, Best Presentation Award. 20 minutes SOAP
30/01/20 **Étude formelle de l'implémentation du code des impôts**, 20 minutes JFLA
07/10/19 **Static Type Analysis of Python Programs: A Type Abstract Domain for Python**, 20 minutes DS@FM

Seminars

28/04/22 **Formal methods for realistic systems: a study of two cases**, 45 minutes LIP, ENS de Lyon
17/03/22 **A Multilanguage Static Analysis of Python/C Programs with Mopsa**, 30 minutes SRG, Imperial, London
31/01/22 **Static Type and Value Analysis of Python Programs with Native C Libraries**, 40 minutes MTV, LaBRI, Bordeaux
31/01/22 **A Multilanguage Static Analysis of Python/C Programs with Mopsa**, 30 minutes SyCoMoRES, Lille
02/12/21 **A Modern Compiler for the French Tax Code**, 40 minutes IRILL, Paris
29/11/21 **Static Analysis of Python Programs with Native C Libraries**, 30 minutes Cash, LIP, Lyon
26/11/21 **A Multilanguage Static Analysis of Python/C Programs with Mopsa**, 30 minutes Binsec, CEA, Saclay
19/11/21 **A Multilanguage Static Analysis of Python/C Programs with Mopsa**, 30 minutes Celtique, IRISA, Rennes
05/07/21 **A Multilanguage Static Analysis of Python Programs with Native C Extensions**, 20 minutes LIP6, Paris
12/03/21 **Mopsa, a Multi-lingual Static Analysis Platform**, 20 minutes GT LVP, GDR GPL
04/11/19 **Formal study of the French tax code's implementation**, 60 minutes INRIA Cambium, Paris
23/10/18 **Static Analysis by Abstract Interpretation of Dynamic Programming Languages**, 20 minutes LIP6, Paris

Posters

02/07/19 **Semantics & Static Type Analysis of Python Programs** SIF PhD day

Community Service

Member of the laboratory's council at LIP6 April 2021-...

Member of the Program Committee

SAS'22

Member of the External Review Committee SPLASH'22

Member of the Artifact Evaluation Committee

SPLASH'22, PLDI'22, CAV'22, ECOOP'21, PLDI'21, POPL'21, SAS'20

External Reviewer SAS'21, ACM TECS, SOAP'21, LOPSTR'19

Student Volunteer POPL'17

Developped Software

Clickable links.

Mopsa, open-source static analysis platform Since September 2018

Main contributor. 60kLoc Ocaml. Implementation and maintenance of the Python analysis and the multilanguage Python/C analysis. LGPL v3 license.

Mlang, open-source compiler for the French Tax code Since May 2019

Main contributor. 10kLoc OCaml. Mlang allows a full replication of the French income tax computation. GPL v3 license.

I am currently helping the French tax administration to adapt and migrate Mlang in their pipeline (link to press release). To that end, I supervise the software development of two research engineers from OCamlPro and one civil servant from the tax administration.

Daisy, a compiler for program on reals. February – June 2017

I contributed to Daisy, which is 14kLoc Scala.

FloVer, mechanized certifacte checker for Daisy. February – June 2017

I generalized the formalization of FloVer, which currently contains 10kLoc HOL and 25kLoc Coq. I was part of the two main developers (with Heiko Becker) during my internship.

Batman, proof-of-concept of a thread-modular static analyzer. June 2015 – January 2017

Only contributor. 5,5kLoc OCaml. GPL v3 license.

Teaching

I've been teaching to computer science students in Sorbonne Université. Total teaching time per level :

- Bachelor, first year (L1) : 79.5h
- Bachelor, second year (L2) : 84.75h
- Bachelor, third year (L3) : 59.5h
- Masters, first year (M1) : 60.5h
- Masters, second year (M2) : 40h

Below are the courses taught from September 2018 to December 2021.

L1	**Introduction to Programming (Python)**, 38.5h	2019–2020
L1	**Introduction to Programming (Python)**, 21h	2018–2019
L1	**Research Workshop (red-black trees and convex hull computation)**, 20h	2018–2019
L2	**Discrete Mathematics**, 44.5h	2021–2022
L2	**Functional Programming (OCaml)**, 19.25h	2021–2022
L2	**Functional Programming (Ocaml)**, 1.75h	2019–2020
L2	**Functional Programming (Ocaml)**, 19.25h	2018–2019
L3	**Advanced Object-Oriented Programming (Java)**, 31.5h	2020–2021
L3	**Compilation**, 28h	2018–2019
M1	**Advanced Algorithmics**, 32h	2021–2022
M1	**Advanced Algorithmics**, 20h	2019–2020
M1	**Research Projects**, 8.5h	2019–2020
M2	**Static Analysis**, 28h	2021–2022
M2	**Program Specification and Validation (Coq)**, 10h	2021–2022
M2	**Research Group in Algorithmics and Programming**, 2h	2019–2020

Languages

- French, mother tongue
- English, certified CEFR B2 level
- German, CEFR B1 level

Programming Languages & Tools

- Day-to-day use: OCaml, Python, C, LaTeX, Beamer
- Regular use of Java, Bash, GoHugo, OBS, and the Coq/HOL4 proof assistants

Community Involvement

Providing fencing classes for students (as a volunteer), 2h to 3h30 per week, 40 week per year	2018–2020
Official training to giving fencing classes, 70 hours	2018–2019