

Raphaël Monat

PHD IN FORMAL METHODS, FOR THE VERIFICATION AND THE ANALYSIS OF PROGRAMS, LIP6, SORBONNE UNIVERSITÉ, FRANCE

23 bd de Brandebourg, 94200 Ivry-sur-Seine

✉ raphael.monat@lip6.fr | 🏠 rmonat.fr | 📞 +33 6 42 33 06 18

Education

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

PhD under the supervision of Antoine Miné

Static Type and Value Analysis by Abstract Interpretation of Python Programs with Native C Libraries.

LIP6, Sorbonne Université, France

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

GPA 16.81/20

Université Paris Diderot, France

2017–2018

Master 2 Fundamental Computer Science

GPA 16.49/20

ENS de Lyon, France

2016–2017

Master 1 Fundamental Computer Science

GPA 16.36/20

ENS de Lyon, France

2015–2016

Bachelor in Fundamental Computer Science

GPA 16.43/20

ENS de Lyon, France

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

“Classes préparatoires MPSI/MP* option informatique”

Lycée Louis-le-Grand, France

2012–2014

Baccalauréat Scientifique, with highest honors

Lycée Aristide Bergès, France

2012

Professional experiences

Temporary teaching and research assistant

Research in collaboration with Antoine Miné. Teaching duties in computer science (192h).

LIP6, Sorbonne Université, France

September 2021 - August 2022

Contractual PhD student with teaching duties

PhD under the supervision of Antoine Miné. Teaching duties in computer science (64h/year).

LIP6, Sorbonne Université, France

September 2018 – November 2021

Master 2 internship under the supervision of Antoine Miné

Static type analysis of python programs.

LIP6, Sorbonne Université, France

March – June 2018

Master 2 internship under the supervision of Eva Darulova

Extending Coq and HOL4 formalizations of Daisy, a synthesizer of numerical programs.

MPI-SWS, Saarbrücken, Germany

February – June 2017

Master 1 internship under the supervision of Hongseok Yang

Variational inference for probabilistic programming languages.

Oxford, United Kingdom

May – July 2016

Bachelor internship under the supervision of Antoine Miné

Static analysis of concurrent programs with a sequentially consistent memory.

Antique, ENS Ulm, France

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

Raphaël Monat, Abdelraouf Ouadjaout, Antoine Miné

SAS 2021
23 pages   

A Modern Compiler for the French Tax Code

Denis Merigoux, Raphaël Monat, Jonathan Protzenko

CC 2021
11 pages   

Static Type Analysis by Abstract Interpretation of Python Programs

Raphaël Monat, Abdelraouf Ouadjaout, Antoine Miné

ECOOP 2020
27 pages  


Combinations of reusable abstract domains for a multilingual static analyzer (Invited)

Matthieu Journault, Antoine Miné, Raphaël Monat, Abdelraouf Ouadjaout

VSTTE 2019
16 pages 


A Verified Certificate Checker for Finite-Precision Error Bounds in Coq and HOL4

Heiko Becker, Nikita Zyuzin, Raphaël Monat, Eva Darulova, Magnus O. Myreen, Anthony Fox

FMCAD 2018
8 pages 

Precise Thread-Modular Abstract Interpretation of Concurrent Programs using Relational Interference Abstractions

Raphaël Monat, Antoine Miné

VMCAI 2017
17 pages 

INTERNATIONAL WORKSHOPS WITH PEER REVIEW

Value and Allocation Sensitivity in Static Python Analyses

Raphaël Monat, Abdelraouf Ouadjaout, Antoine Miné

SOAP 2020
6 pages 

NATIONAL CONFERENCES WITH PEER REVIEW

Mlang: an Open-Source Toolchain for the Income Tax Computation

Denis Merigoux, Raphaël Monat

JFLA 2021
2 pages  

Démonstration de la plateforme Mopsa d'analyse statique de programmes par interprétation abstraite

Matthieu Journault, Antoine Miné, Raphaël Monat, Antoine Miné

JFLA 2021
2 pages  

Étude formelle de l'implémentation du code des impôts


Denis Merigoux, Raphaël Monat, Christophe Gaie

JFLA 2020
16 pages 

MANUSCRIPT AND TECHNICAL REPORTS


Static Type and Value Analysis by Abstract Interpretation of Python Programs with Native C Libraries

Raphaël Monat

Thesis (2021)
275 pages 

Static Analysis by Abstract Interpretation Collecting Types of Python Programs

Raphaël Monat

Internship report (M2, 2018)
20 pages 

Certificate Checking in Coq and HOL4 for Static Analyses of Mixed-Precision Floating-Point Arithmetic

Raphaël Monat

Internship report (M2, 2017)
24 pages 


Variational Inference in Probabilistic Programs: formal derivation of a black-box approach

Raphaël Monat

Internship report (M1, 2016)
26 pages 

Thread-Modular Analysis designing relational abstractions of interferences

Raphaël Monat

Internship report (L3, 2015)
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