

Curriculum Vitæ

Thanos Tsouanas

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► Personal details

full name: Thanos Tsouanas email address: thanos@tsouanas.org
date of birth: 1983-02-22 personal website: <https://tsouanas.org/>
nationality: Greek GitHub: <https://github.com/tsouanas>



Spoken languages

Greek (native); English (proficient); Portuguese (fluent).

► Studies & academic positions

2016– **Assistant Professor** (permanent position) in the institute IMD of UNIVERSIDADE FEDERAL DO RIO GRANDE DO NORTE (UFRN), Brazil.

2015 Postdoctoral researcher in the Mathematics Department of UFRN, Brazil.

2014 PhD from ÉCOLE NORMALE SUPÉRIEURE (ENS) DE LYON, under the supervision of Olivier Laurent,¹ in the field of **theoretical computer science**. I was employed by CNRS under the **Marie Curie fellowship** “MALOA”,² and had a 1-month secondment split between the UNIVERSITY OF OXFORD (team of Luke Ong)³ and ÉCOLE POLYTECHNIQUE (team of Dale Miller).⁴

Thesis title: *On the Semantics of Disjunctive Logic Programs*.⁵

2010 MSc degree from MPLA (graduate program in Logic, Algorithms and Computation of the UNIVERSITY OF ATHENS and of the TECHNICAL UNIVERSITY OF ATHENS),⁶ **mathematical logic** specialty, grade 8.23/10.

2007 Bachelor’s degree from the Department of Mathematics of the UNIVERSITY OF ATHENS, **pure mathematics** specialty, grade “excellent” (8.51/10).

Seminars and schools

- **Midlands Graduate School 2022** in the Foundations of Computer Science: Nottingham, UK (2022)
- **Logoi** school on Linear Logic and Geometry of Interaction. Torino, Italy (2013)
- **ISR2012** 6th International School on Rewriting. Valencia, Spain (2012)
- **LICS** pre-conference tutorial day on *term rewriting systems*: Dubrovnik, Croatia (2012)
- **MAP** international spring school on Formalization of Mathematics: INRIA, Sophia–Antipolis (2012)
- **EPIT-GAMES** spring school on language theory, games & applications: Carcans, France (2011)
- **MALOA training workshop** Fischbachau, Germany (2010); Leeds & Oxford, UK (2011 & 2012)
- **Midlands Graduate School 2008** in the Foundations of Computer Science: Birmingham, UK (2008)
- **Summer School of Mathematics** University of Crete & FORTH (2004)

► Distinctions & awards

Academic. **(1)** Two scholarships for excellence in studies and for *student with the highest grades* for the year 2002–2003 at the Mathematics Department of the University of Athens, from the National Foundation IKY. **(2)** **Marie Curie** fellowship for PhD 2010–2013. **(3)** My PhD thesis has been used as the example on a multi-disciplinary “*How to write a thesis*” seminar organized by Katya Komendantskaya at HERIOT–WATT UNIVERSITY.

Music composition. Best original soundtrack composition prize for the computer game HERO QUEST 6 (2003).⁷

Web development. Second prize on a panhellenic web development contest organized by AMSTEL (in 1996).

¹<http://perso.ens-lyon.fr/olivier.laurent/>

²Mathematical Logic and Applications

³<http://www.cs.ox.ac.uk/people/luke.ong/>

⁴<http://www.lix.polytechnique.fr/~dale/>

⁵My thesis and defense slides are available on my website.

⁶<http://mpla.math.uoa.gr/>

⁷<https://the.thanos.band/fairies/>

► Teaching experience

More information about my recent teaching activities (including **video recordings of whole semester classes**) can be found on my teaching website.⁸

Full teaching of courses as a professor at UFRN

Since the beginning of 2016, I have been teaching courses occupying 10h–18h (in class!) per week, every semester. Further information, exams (including markings), syllabus, and detailed log of lectures and assignments for each class I have taught can be found on my teaching website.

FMC1: Mathematical Foundations for Computation I (14 times)

6h/week; 90h/semester; required course

introduction to mathematical definitions and proofs (using the theory of integers and the theory of reals); structural recursion and induction (using functional programming); number theory and modular arithmetic; analysis (sequences and metric spaces); combinatorics.

FMC2: Mathematical Foundations for Computation II (18 times)

6h/week; 90h/semester; required course

mathematical logic; sets, functions, relations; countable and uncountable sets; introduction to algebra and algebraic structures (semigroups, monoids, groups, lattices); group theory; categories and universal properties; axiomatic set theory; order & lattice theory.

Functional Programming (4 times)

4h/week; 60h/semester; optional course

recursive/inductive data types; structural recursion and induction; higher order programming, strict and lazy evaluation, I/O, typeclasses, functors, applicatives, and monads; reasoning about programs, inductive proofs; λ -calculus and computational models of functional programming; programming with dependent types.

Topics: Category Theory & Order Theory (3 times)

4h/week; 60h/semester; optional course

categorical definitions and universal properties; functors; natural transformations; preorders, posets, cpos, and dcpo; fixpoint theorems; F -algebras and coalgebras; categorical semantics.

Topics: General Topology

2h/week; 30h/semester; optional course

metric spaces; topological spaces; alternative definitions of a topology and related concepts; continuity; compactness; countability axioms; separation axioms; applications to logic and computer science.

Algebraic Structures

4h/week; 60h/semester; optional course

algebraic structures (semigroups, monoids, lattices, groups); homomorphisms, subalgebras, quotients; Heyting and boolean algebras; universal algebra; category theory (definitions via universal properties, (co)products, (co)equalizers, (co)limits, etc.); applications to computer science

Topics: Type Theory & friends (2 times)

4h/week; 60h/semester; optional course

intuitionistic logic and constructive mathematics; proof theory (natural deduction, sequent calculus); functional programming; λ -calculus; Martin-Löf Type Theory; Curry–Howard “correspondence”; connections with topology and category theory; HoTT; proof assistants and formalization of mathematics.

Topics: Denotational Semantics

4h/week; 60h/semester; optional course

programming paradigms: imperative and declarative programming paradigms; syntax and semantics for imperative, functional, and logic programming languages; operational semantics; domain theory and domain-theoretic semantics; model-theoretic semantics; game-theoretic semantics; fixpoint theorems and the use of fixpoints in semantics; dealing with negation and disjunctions in logic programs.

Topics: Sets, Functions, Relations

4h/week; 60h/semester; optional course

Covered 2/3 of FMC2, taught during the very first months of the pandemic as a voluntary and experimental course during the transition period to remote teaching. The aim was to help students prepare for the actual FMC2 course, by having them produce their own definitions and proofs that involved sets, functions, relations, and the corresponding language, notation, and ideas.

Teaching Assistance project

FMCn (2017–). I have been granted multiple scholarships for a teaching assistance project that I have created and have been coordinating since 2017, relevant to our department’s required courses FMC1, FMC2, and FMC3 (see above). The project has had enormous success, has been influential for other projects of the department, and has achieved scholarship renewals every year since its creation. For more information about the project, you can check its website.⁹

⁸<https://tsouanas.org/teaching/>

⁹<https://fmc.imd.ufrn.br/>

Evaluation by students

I am very happy to have been receiving consistently top evaluation marks by the anonymous feedback that UFRN students provide at the end of each semester. On my teaching website I make public all such reviews and feedback regarding my teaching for each class I have taught.¹⁰

Creation/design of syllabus

In collaboration with my colleague, João Marcos, we have created syllabuses, descriptions, and full outlines of multiple subjects, including the organization of the introductory courses of mathematics and programming, and also the field of mathematical foundations of computer science, shared with the Department of Applied Mathematics and Informatics. Please check my teaching website for information about the most influential courses I have created and introduced to the department.

fmcbok: book on foundations of mathematics and computation

This is a work-in-progress (currently ~900 pages in Portuguese) but has already been used extensively for teaching by me and by colleagues as well as for self study by many students around the world. I follow a novel approach at this level, favoring a type-theoretic, category-theoretic, and computational approach, emphasizing the interplays between syntax and semantics, specifications and implementations, statics and dynamics, synthetics and analytics, and intensions and extensions. The content emerged as *a transition from mathematical foundations for computation to computational foundations for mathematics*. One of the objectives is to develop all theories in a foundations-agnostic manner, despite the aforementioned influences driving the methodology. It is available as a PDF on my website¹¹ and its full source code (~88,500 LoC) is on my GitHub.¹²

To typeset this book, I have developed $\Theta\&\text{T}_{\text{E}}\text{X}$, an open source plain $\text{T}_{\text{E}}\text{X}$ macro suite for creating mathematical books, lecture notes, and exams. Its source code (~6,600 LoC) is also available on my GitHub.¹³

Recorded classes (thanosmath), self-study guides, and blackboard notes (PDF and videos)

On my YouTube channel¹⁴ I publish entire semesters of recorded lectures of selected classes that I have taught, including some seminars, tutorials, and crash-courses. The material (~320 videos, averaging 100' each) is organized into playlists and I have created self-study sites¹⁵ to help students who are tackling these subjects on their own.

Tutorials, mini-courses & seminars

These, I have prepared and taught since the years of my studies in the University of Athens up until my current years of working as a professor in UFRN, Brazil. The attendants are mostly university students and professors.

Typesetting correctly with $\text{T}_{\text{E}}\text{X}$ (2006, 2016, 2017) 6h–8h; participants: 30–40
The focus was on correct (semantical) typesetting, an introduction to programming in $\text{T}_{\text{E}}\text{X}$, and a presentation of some \LaTeX packages.

Functional programming with Haskell (2009, 2017) 12h–14h; participants: 40
The computational model of Haskell; introduction to λ -calculus; types; typeclasses; recursion; higher-order functions; evaluation strategies; I/O; presentation of the early source code of *xmonad*.

Open-source: Unix, \LaTeX , Python (2005) one semester, 2h/week; participants: 40
The basics of Unix and its philosophy: shell; pipes; permissions; scripting; editing and text processing with Vim. Typesetting with $\text{T}_{\text{E}}\text{X}/\text{\LaTeX}$. Introduction to Python: scripts; imperative and object-oriented programming.

Introduction to Unix: tools and philosophy (2016) 9h; participants: 10–20
Philosophy of Unix, Unix tools, streams and pipes, permissions, shell scripting, the Vim editor.

Server-side and client-side programming (2004) 6 weeks, 2h/week; participants: 30
A simple web blog application was built along the lectures, to demonstrate the basic principles of web programming, concluding with a lecture on basic SQL and database interaction.

Front-end web development: HTML and CSS (2003) 12h; participants: 80
Coding in HTML and CSS; basic principles of how the World Wide Web works and the HTTP protocol. By the end of the course the attendants were using FTP to maintain their sites on the department's web server.

¹⁰<https://tsouanas.org/teaching/reviews/>

¹¹<https://tsouanas.org/fmcbok/>

¹²<https://github.com/tsouanas/fmcbok>

¹³<https://github.com/tsouanas/thatex>

¹⁴<https://youtube.com/c/thanosmath>

¹⁵<https://tsouanas.org/teaching/self/>

► Research

For the most part of my PhD studies, I was working on game semantics and logic programming. Firstly, I extended the game semantics of LP¹⁶ to cover finite propositional *disjunctive* logic programs. Next, I showed how to deal with *infinite* propositional DLP: an important step, since it allows one to give a semantics to first-order disjunctive logic programs. My paper with these results was published in 2013 (see below) and you can find it online on my website, together with slides from a related talk. By finding connections between these games and the Hyland–Ong games used in functional programming one could provide a semantical link between the two programming paradigms through games. The formalization and overall development of the DLP games was made with this goal in mind.

I defined an abstract semantic framework for denotational semantics of logic programs, and a semantic operator which transforms any given semantics of a non-disjunctive language to a new semantics, of the equivalent disjunctive language. I used this operator to obtain a novel game semantics for DLPN.

I am currently investigating type theories as foundations of mathematics and their use in proof assistants and the formalization of mathematics. I am also highly interested in (and very passionate about) teaching of mathematics and computation in general, and mathematics education as a research field, including the use of proof assistants and type theoretic foundations in teaching mathematics.

Research interests: mathematical foundations, type theory, constructive mathematics, denotational semantics, theory of programming languages, formalization of mathematics, mathematics education.

Publications

(Journal) Thanos Tsouanas, **A game semantics for disjunctive logic programming**
ANNALS OF PURE AND APPLIED LOGIC, Vol. 164 (11), pp. 1144–1175, Elsevier, 2013.

(Conference) Thanos Tsouanas, **An abstract semantic framework for logic programming**
LSFA2018, Fortaleza, Brazil, 2018.

(Book) Thanos Tsouanas, **fmcbook (Foundations: Mathematics & Computation)**
<https://tsouanas.org/fmcbook>, (~900 pages), work in progress, to be published.

Talks

- **Game semantics for logic programming:**
 - MALOA 2010 training workshop: Fischbachau, Germany
- **A game semantics approach for finite, propositional disjunctive logic programs:**
 - GaLoP VI (Games for Logic and Programming Languages): Saarbrücken, Germany
 - LAC–GeoCal 2011: École Polytechnique, Paris, France
 - MALOA 2011 training workshop: Leeds, UK
 - PL Seminar NTUA/IEEE-GR 2011 seminar: Athens, Greece
- **A game semantics for disjunctive logic programs:**
 - University of Oxford (May 2012)
 - University of Bath (Sep 2012)
 - LIX, École Polytechnique, Paris (Jan 2013)
 - UFMG, Belo Horizonte, Brazil (Mar 2014)
- **On the semantics of disjunctive logic programs:**
 - Demokritos Research Center, Athens, Greece (Jan 2015)
 - UFRN, Natal, Brazil (Mar 2015)

Participation in conferences & scientific events

- **Réalisabilité à Chambéry 2011.**
- **ETAPS 2011** Saarbrücken, Germany.
- **LI2012** (Logic and Interactions), CIRM, Marseille, France.
- **CHoCoLa** (Curry–Howard: Logic and Computation), monthly seminar in Lyon, France.
- **LICS2012**, (Logic in Computer Science) June 25–28, 2012, Dubrovnik, Croatia.
- **GaLoP VII**, June 29, 2012, Dubrovnik, Croatia.
- **PLS9**, Panhellenic Logic Symposium, Julho 15–18, 2013, Atenas, Grécia.

¹⁶(D)LP(N) stands for (Disjunctive) Logic Programming (with Negation).

► Working experience (in industry & academia)

Here are some of the jobs I have had along with a short description of my duties.

UFRN, IMD (2016–) Assistant Professor (permanent position) at the institute IMD of the Federal University of Rio Grande do Norte (UFRN). Duties *heavily* prioritize teaching but also include: course design, academic orientation and supervision of students, research & extension, as well as some administrative work.

UFRN, Mathematics Department (2015) Postdoctoral researcher in the department of mathematics of UFRN.

CNRS (2010–2014) Employed as a researcher to complete my PhD studies in mathematical logic under the **Marie Curie fellowship** “MALOA”.

Springer Verlag Publishing (2005, 2009, 2010)

- Proof-reading of Y. N. Moschovakis’s book *Notes on Set Theory*, 2nd edition.
- Proof-reading of M. Chlouveraki’s book *Blocks and Families for Cyclotomic Hecke Algebras*.
- Typesetting, diagram design and indexing for the greek translation of S. Lang’s *Algebra*.

MPLA graduate program, University of Athens (2007–2010) Setup and system administration of the main server (OpenBSD) for the postgraduate program MPLA. Web development and design of the rather sophisticated website of MPLA (still running)¹⁷ for which I developed my university-targeted framework **schole**, mostly written in Django, with PostgreSQL & SQLite database backends. This is a complete administrative system for students, professors, and secretary alike, with course registrations, scheduling, graduation management, e-courses, etc.

Nefeli Publishing (2007, 2009)

- Translation into greek, editing, proof-reading and \LaTeX typesetting, of Y. N. Moschovakis’s book *Notes on Set Theory*, 2nd edition.
- Typesetting of a collective volume of articles on logic, edited by D. Anapolitanos.

Mathematics Department, University of Athens (2002–2009)

- Preparation and teaching of mini-courses and seminars (see Teaching section for details).
- Technical support for the 4th Computability in Europe conference, CiE2008.
- Computer labs assistant (2002–2003) doing Unix system administration and web development.

Alpha News 98,7 FM (2001–2002) I was the web developer & designer for the radio station’s website. I designed a new website from scratch; and developed the content management system (in PHP & Oracle) to be used by reporters. I provided constant (24/7) support and trained the reporters who had zero to light computer experience, to use the web application.

School of Civil Engineering, NTUA (2009) Web development and design of the school’s website. System administrator of the department’s main server (OpenBSD).

Zermelo Hosting Services (2002–2008) System administrator (OpenBSD) of servers (dns, web, mail, database), tech support for my hosting and web development/design customers, with 0 downtime and neither security nor performance issues.

1st high school of Kessariani, Athens (2004–2005) Technical support for five educational programs for high school teachers, organized by the Greek Ministry of Education. System administration of Windows 2000 Server and Red Hat Linux machines, as well as instructor for some of the lectures.

Hellenic Mathematical Society (2005) Assistant in the organization of the 9th Junior Balkan Mathematical Olympiad, Veria, June 2005.

Hero6 (2003) Honorary member of the development team of *Hero Quest 6* as an original music composer.

Necroulis hosting (2015–) System administrator (OpenBSD) of servers (dns, web).

Freelance programmer developing software and web applications for individuals and companies.

Tutoring of university students (private lessons and group classes).

¹⁷<http://mpla.math.uoa.gr/>

► Computer skills

I develop open source software, web applications, libraries and scripts, about which you can find more information on my website and GitHub. I also administer servers with multiple users, who rely on them for their email, web hosting, proxies, file storage, databases, backups, etc.

Computer languages

- Haskell, Python, Racket, Rust, C, Scala, ...
- Agda, Lean, Coq, Idris, λ Prolog
- \TeX & \LaTeX
- Shell scripting & Unix programming
- HTML, CSS, JavaScript
- SQL, Sinatra, Elm, IHP, Django, Ruby on Rails, ...

Operating Systems

Over 25 years of experience in the **BSD Unix** operating systems, especially in **OpenBSD**. I am also experienced in other Unix-like systems, including various distributions of **Linux**.

System & network administration

- **web servers** (nginx, httpd & relayd)
- **mail servers** (OpenSMTPD, Postfix, qmail)
- **file servers** (FTP, Samba, NFS)
- **domain name servers** (named)
- **firewalls & routers** (PF packet filter)
- **databases** (PostgreSQL)

Web development & databases

I am a seasoned web developer (began with the first version of HTML in 1995), now using HTML5, CSS, and JavaScript-generating languages for web design and Haskell, Elm, Python, (usually with web frameworks such as IHP, Django, etc.) for web development and interaction with databases. I have a good command of SQL and of the relational database management systems such as **PostgreSQL**.

Audio & graphics

More than 27 years of experience in **MIDI sequencing** and audio recording, using audio software applications (such as Reaper), for composing, recording and editing music and audio in general. Good level of the image creation and editing application **GIMP**, for designing and editing graphics for websites, programs, covers, etc.

► Music

I have been composing, arranging, orchestrating and performing music since 1996. I enjoy mixing, mastering, recording, and producing music. You can find more information and music samples on my music website¹⁸ and on Spotify. I play (my skill varying from awful to intermediate) the following musical instruments, among others: piano, guitar, bass, baroque recorders, glockenspiel, ocarina, cretan laouto, ...



¹⁸<https://the.thanos.band/>