# Fernando **Macías**

Computer Scientist, Post-doctoral Researcher, Ph.D.

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Fernando Macías is a post-doctoral researcher in the areas of Software Engineering and Computer Science. His work includes creative thinking, study of technical publications, tool prototyping and dissemination of research.

In recent years, Fernando has earned a PhD after extensive research, including the development of the open-source tool MultEcore and the publication of a PhD dissertation. More recently, he is involved in transferring research results to the aerospace industry for the safe and efficient development of critical embedded software.

Fernando holds a PhD in Informatics from the University of Oslo, Norway, and an MSc, Major and BSc from the University of Extremadura, Spain. He has lived in three countries and speaks English, Spanish and Norwegian.

## Experience

**Post-doc Researcher**, IMDEA Software Institute, Madrid, Spain 2019–
Research on the state of the art and state of the practice of software reliability for embedded systems, with special focus on test generation, code analysis, model-based testing and symbolic execution.

**Part-time Lecturer**, Dep. of Information Systems Eng., University of Extremadura, Spain 2019
Teaching of the Bachelor course Concurrent and Distributed Programming (see Teaching below).

**R&D Engineer**, Homeria Open Solutions, Spain 2019

**Guest Researcher**, Dep. of Computer Science, Universidad Autónoma de Madrid, Spain 2017
Research on multi-level modelling.

**PhD Research Fellow**, Dep. of Software Engineering and Computing, Western Norway University of Applied Sciences, Norway 2015–2019
75% research on formal aspects of model-driven engineering. Development of MultEcore, a framework for multi-level modelling and multilevel model transformation founded on graph theory and category theory. 25% teaching, evaluating and carrying out lab sessions in courses at the Master level.

**Lecturer**, EITIE Plan for Innovation and Entrepreneurship, University of Extremadura, Spain 2013
Teaching of the seminar Cloud-based Services for Software Development (see Teaching below).

**Research Fellow**, Quercus Software Engineering Group, University of Extremadura, Spain 2013–2015
Research on model-based reverse engineering of legacy web applications and its modernisation into rich internet applications using model-to-model transformation and code generation, and on model transformation verification using statistical methods.

## Projects

**MFoC**, techniques to improve the testing and verification of new-generation satellite systems 2019–2022
Co-funded project by Comunidad de Madrid and European Regional Development Fund (ERDF).
Main Researcher.

**MultEcore**, a tool for multilevel modelling and multilevel model transformation in EMF 2015–2019
Funded by the Western Norway University of Applied Sciences.
PhD Research Fellow.

**MLM Rearchitecting**, a tool for automatic rearchitecting of models into multilevel models 2017–2018

**RV+MM**, an approach to integrate runtime verification techniques into modelling processes 2016–2019

**Nubalia**, a system for information retrieval in microblogs with topic and sentiment analysis 2013–2015

**MoTES**, a model transformation testing approach based in contracts 2013–2021

**MIGRARIA**, a model-driven reverse engineering & modernisation process of legacy web apps 2013–2015
Co-funded by TIN2011-27340, GR-10129 and European Regional Development Fund (ERDF).
Researcher.

## Management

**Web Editor**, MFoC Project and MFoC Workshop, IMDEA Software Institute, Spain 2019–

**Student Union Member**, Polytechnic School, University of Extremadura, Spain 2013–2014

## Organisation

Organising Committee Member: MFoC Workshop 2019, NIKT 2016, European Researcher's Night 2013

Program Committee Member: MULTI 2021, MULTI 2020, MULTI 2019

Reviewer: SoSyM, IEEE Access, MULTI 2021, MULTI 2020, MULTI 2019, MULTI 2018, NIKT 2016, The 13th Overture Workshop (2015)

## Education

**Philosophiae Doctor (PhD)**, Department of Informatics, University of Oslo, Norway 2019
Subject of the dissertation: Multilevel Modelling and Domain Specific Languages.
Supervisors: Adrian Rutle and Volker Stolz. Opponents: Thomas Kühne and Reiko Heckel.

**Master of Science (MSc)**, D. of Information Systems Eng., University of Extremadura, Spain 2014
Advanced curriculum in computer science and software engineering. Final mark 8,467/10. Master's research thesis distinction. Subject of the dissertation: Verification of Model-to-Model Transformations using Metrics. Supervisor: Roberto Rodríguez Echeverría.

**Science Major**, Dep. of Information Systems Engineering, University of Extremadura, Spain 2013
Advanced curriculum in computer science and software engineering. Final mark 8,066/10. Senior research thesis distinction. Subject of the dissertation: Generating a RIA Client from a Legacy Web Application. Supervisor: Roberto Rodríguez Echeverría.

**Bachelor of Science (BSc)**, D. of Information Systems Eng., University of Extremadura, Spain 2011
General curriculum in computer science and software engineering.

## Awards

**Distinguished Student Award** May 2015
Polytechnic School, University of Extremadura, Spain

**Best Academic Record Award** Software Engineering Master's Degree Feb 2015
Professional Association of Software Engineers of Extremadura, Spain

**Best Academic Record Award** Software Engineering Master's Degree Jan 2015
University of Extremadura, Spain

**1st Prize in the category Health and Wellbeing at All Ages** H4SB Hackaton Sep 2013
Campus Party Europe, London, United Kingdom

**Best Non-verbal Communication** Debate Team of the Polytechnic School Apr 2010
University of Extremadura, Spain

**Educational Excellence Award** Best academic record in Extremadura to matriculate for Software Engineering Nov 2008
Savings Bank of Extremadura, Spain

## Courses

**ArVi Summer School on Runtime Verification**, ArVi COST Action, Madrid, Spain Sep 2016

**Communicating Scientific Research**, Simula School of Research & Innovation, Oslo, Norway 2016

**Developing Android Apps**, Udacity, Online 2014

## Teaching

**Lecturer and Lab Instructor**, Concurrent and Distributed Programming (English and Spanish) Spring 2019
Bachelor course 501284, University of Extremadura

**Lecturer and Lab Instructor**, Advanced Software Technologies (English) Fall 2018
Master course DAT250, Western Norway University of Applied Sciences

**Lecturer**, Modern Software Development Methods (English) Spring 2018
Master course DAT251, Western Norway University of Applied Sciences

**Lecturer and Lab Instructor**, Advanced Software Technologies (English) Fall 2017
Master course DAT250, Western Norway University of Applied Sciences

**Lecturer and Lab Instructor**, Advanced Software Technologies (English) Fall 2016
Master course DAT250 (former MOD250), Western Norway University of Applied Sciences

**Lecturer**, Modern Software Development Methods (English) — Spring 2016
Master course DAT251 (former MOD251), Western Norway University of Applied Sciences

**Lecturer**, Advanced Software Technologies (English) — Fall 2015
Master course DAT250 (former MOD250), Western Norway University of Applied Sciences

**Lecturer**, Cloud-based tools for Software Developers (Spanish) — Fall 2013
EITIE training courses for entrepreneurship, University of Extremadura

## Supervision

Juan Francisco García Casado, Research Intern at IMDEA Software Institute. — 2020–

Leif Arne R. Johnsen, Master student in Software Engineering at Western Norway University of Applied Sciences. Master's thesis at Western Norway University of Applied Sciences. Subject of the dissertation: Towards a multilevel model transformation engine. — 2017

Gabor Stajer, Bachelor student in Computer Systems Networking and Telecommunications, Budapest University of Technology and Economics. IAESTE exchange student at Western Norway University of Applied Sciences. — 2016

Rodrigo Vilaça, Bachelor student in Computer Engineering, University of Brasilia. IAESTE exchange student at Western Norway University of Applied Sciences. — 2016

## Computer skills

Software engineering: EMF, Java, C/C++, Go, Bash, SQL, HTML, CSS, JavaScript, XML, JSON

System administration: GNU/Linux, Android, macOS, MySQL, Subversion, Git

Collaborative tools: Slack, Mattermost, Trello, GDocs, Overleaf

Desktop publishing: LaTeX, Beamer, TikZ, BibTeX, Biber, Emacs, Microsoft Office, LibreOffice, Inkscape, GIMP

## Languages

Mother tongue: **Spanish**

Other languages[1]:

| | Understanding | | | | Speaking | | | | Writing | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Listening | | Reading | | Interaction | | Production | | | |
| **English**[2] | C2 | Fluent | C2 | Fluent | C2 | Fluent | C2 | Fluent | C2 | Fluent |
| **Norwegian (Bokmål)**[3] | A2 | Basic | A2 | Basic | A2 | Basic | A2 | Basic | A2 | Basic |

[1] *Common European Framework of Reference for Languages (CEFR)*
[2] *Completed all courses at Official School of Languages in Badajoz, Spain*
[3] *Tok A1 og A2 kurs på Folkeuniversitetet i Bergen*

## Publications

### Peer-reviewed journals

[1] Suggesting model transformation repairs for rule-based languages using a contract-based testing approach
Roberto Rodriguez-Echeverria, Fernando Macías, Adrian Rutle, José M Conejero
*Software and Systems Modeling* (2021) pp. 1–32. Springer, 2021. DOI: 10.1007/s10270-021-00891-0

[2] Multilevel Coupled Model Transformations for Precise and Reusable Definition of Model Behaviour
Fernando Macías, Uwe Wolter, Adrian Rutle, Francisco Durán, Roberto Rodríguez-Echeverría
*Journal of Logical and Algebraic Methods in Programming* 106 (Aug. 2019) pp. 167–195. Elsevier, 2019. DOI: 10.1016/j.jlamp.2018.12.005

[3] An Approach to Flexible Multilevel Modelling
Fernando Macías, Adrian Rutle, Volker Stolz, Roberto Rodríguez-Echeverría, Uwe Wolter
*Enterprise Modelling and Information Systems Architectures* 13 (2018) 10:1–10:35. 2018. DOI: 10.18417/emisa.13.10

[4] Legacy Web Application Modernization by Generating a REST Service Layer
Roberto Rodríguez-Echeverría, Fernando Macías, Victor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
*IEEE Latin America Transactions* 13 (July 2015) pp. 2379–2383. 2015. DOI: 10.1109/TLA.2015.7273801

## Peer-reviewed conferences and workshops

[1] An application of KLEE to aerospace industrial software
Juan Francisco García, Daniel Jurjo, Fernando Macías, Jose F. Morales, Alessandra Gorla
*XX Jornadas de Programación y Lenguajes (PROLE 2021)*, 2021

[2] Multilevel Typed Graph Transformations
Uwe Wolter, Fernando Macías, Adrian Rutle
*Graph Transformation*, 2020. DOI: 10.1007/978-3-030-51372-6_10

[3] Composition of multilevel modelling hierarchies
Alejandro Rodríguez, Adrian Rutle, Francisco Durán, Lars Michael Kristensen, Fernando Macías, Uwe Wolter
*Nordic Workshop on Programming Theory (NWPT)*, 2019. DOI: 10.23658/taltech.nwpt/2019

[4] Multilevel Modelling with MultEcore: A Contribution to the MULTI Process Challenge
Alejandro Rodríguez, Fernando Macías
*6th International Workshop on Multi-Level Modelling (MULTI 2019)*, 2019. DOI: 10.1109/MODELS-C.2019.00026

[5] Empowering Multilevel DSMLs with Integrated Runtime Verification
Fernando Macías, Adrian Rutle, Volker Stolz, Torben Scheffel, Malte Schmitz
*Proceedings of the 3rd International Workshop on Verification of Objects at Runtime Execution (VORTEX 2019)*, 2019

[6] Fuentes de Sobrecarga en Pruebas de Transformaciones de Modelos
Roberto Rodríguez-Echeverría, Fernando Macías, José M. Conejero, Juan C. Preciado, Alvaro E. Prieto, Adrian Rutle
*Jornadas de Ingeniería del Software y Bases de Datos (JISBD)*, 2018

[7] Multilevel modelling of coloured Petri nets
Alejandro Rodríguez, Adrian Rutle, Francisco Durán, Lars Michael, Fernando Macías
*5th International Workshop on Multi-Level Modelling (MULTI 2018)*, 2018

[8] A Tool for the Convergence of Multilevel Modelling Approaches
Fernando Macías, Adrian Rutle, Volker Stolz
*5th International Workshop on Multi-Level Modelling (MULTI 2018)*, 2018

[9] Towards Domain-Specific CPN Modelling Languages
Alejandro Rodríguez, Fernando Macías, Lars Michael Kristensen, Adrian Rutle
*Nordic Workshop on Programming Theory (NWPT)*, 2017. ISBN: 978-952-12-3608-2

[10] Towards an Autonomous Robot Architecture Combining Complex Event Processing and Multilevel Modelling
Juan Boubeta-Puig, Fernando Macías, Adrian Rutle
*Nordic Workshop on Programming Theory (NWPT)*, 2017. ISBN: 978-952-12-3608-2

[11] Coordination and Amalgamation of Multilevel Coupled Model Transformations
Fernando Macías, Adrian Rutle, Volker Stolz
*Nordic Workshop on Programming Theory (NWPT)*, 2017. ISBN: 978-952-12-3608-2

[12] Multilevel Modelling with MultEcore: A Contribution to the MULTI 2017 Challenge
Fernando Macías, Adrian Rutle, Volker Stolz
*4th International Workshop on Multi-Level Modelling (MULTI 2017)*, 2017

[13] Towards rearchitecting meta-models into multi-level models
Fernando Macías, Esther Guerra, Juan Lara
*International Conference on Conceptual Modeling*, 2017. DOI: 10.1007/978-3-319-69904-2_5

[14] Describing Behaviour Models through Reusable, Multilevel, Coupled Model Transformations
Adrian Rutle, Fernando Macías, Francisco Durán, Roberto Rodríguez-Echeverría, Uwe Wolter
*Nordic Workshop on Programming Theory (NWPT)*, 2016

[15] Integration of Runtime Verification into Metamodeling
Fernando Macías, Torben Scheffel, Malte Schmitz, Rui Wang, Martin Leucker, Adrian Rutle, Volker Stolz
*Nordic Workshop on Programming Theory (NWPT)*, 2016

[16] Multilevel Behavioural Metamodelling
Fernando Macías, Adrian Rutle, Volker Stolz
*Nordic Workshop on Programming Theory (NWPT)*, 2016

[17] On Reducing Model Transformation Testing Overhead
Roberto Rodríguez-Echeverría, Fernando Macías, Adrian Rutle

*2nd Joint International Workshop on Patterns in Model Engineering and the 5th International Workshop on the Verification of Model Transformation (PAME-VOLT 2016)*, 2016

[18] MultEcore: Combining The Best of Fixed-Level and Multilevel Metamodelling
Fernando Macías, Adrian Rutle, Volker Stolz
*3rd International Workshop on Multi-Level Modelling (MULTI 2016)*, 2016

[19] Integration of Runtime Verification into Metamodeling for Simulation and Code Generation (Position Paper)
Fernando Macías, Torben Scheffel, Malte Schmitz, Rui Wang
*16th International Conference in Runtime Verification (RV 2016)*, 2016. DOI: 10.1007/978-3-319-46982-9_29

[20] A Heuristic Approach for Resolving the Class Responsibility Assignment Case
Maximiliano Vela, Yngve Lamo, Fazle Rabbi, Fernando Macías
*9th Transformation Tool Contest (TTC 2016)*, 2016

[21] A Property Specification Language for Runtime Verification of Executable Models
Fernando Macías, Adrian Rutle, Volker Stolz
*Nordic Workshop on Programming Theory (NWPT)*, 2015

[22] A statistical analysis approach to assist model transformation evolution
Roberto Rodríguez-Echeverría, Fernando Macías
*MODELS*, 2015. DOI: 10.1109/MODELS.2015.7338253

[23] Formalización de Modelos de Comportamiento
Fernando Macías
*Jornadas de Concurrencia y Sistemas Distribuidos (JCSD)*, 2015

[24] Herramienta de soporte en procesos de modernización, para las fases de ingeniería inversa y reestructuración
Víctor M. Pavón, Roberto Rodríguez-Echeverría, Fernando Macías, Pedro J. Clemente, Fernando Sánchez-Figueroa
*Jornadas de Ingeniería del Software y Bases de Datos (JISBD)*, 2014. ISBN: 978-84-697-1152-1

[25] Proceso de verificación de reglas de transformación basado en métricas
Fernando Macías, Roberto Rodríguez-Echeverría, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
*Jornadas de Ingeniería del Software y Bases de Datos (JISBD)*, 2014. ISBN: 978-84-697-1152-1

[26] IFML-based model-driven front-end modernization
Roberto Rodríguez-Echeverría, Víctor M. Pavón, Fernando Macías, José M. Conejero, Pedro J. Clemente, Fernando Sánchez-Figueroa
*Proceedings of the 23rd International Conference on Information Systems Development, (ISD 2014)*, 2014. ISBN: 978-953-6071-43-2

[27] Generating a REST Service Layer from a Legacy System
Roberto Rodríguez-Echeverría, Fernando Macías, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
*Information System Development* (2014) pp. 433–444. Springer International Publishing, 2014. DOI: 10.1007/978-3-319-07215-9_35

[28] Generación dirigida por modelos de una API REST para una aplicación Web heredada
Fernando Macías, Víctor M. Pavón, Roberto Rodríguez-Echeverría, Fernando Sánchez-Figueroa
*Jornadas de Ingeniería del Software y Bases de Datos (JISBD)*, 2013. ISBN: 978-84-695-8310-4

[29] Model-driven generation of a REST API from a legacy web application
Roberto Rodríguez-Echeverría, Fernando Macías, Víctor M. Pavón, José M. Conejero, Fernando Sánchez-Figueroa
*International Conference on Web Engineering*, 2013. DOI: 10.1007/978-3-319-04244-2_13

[30] Generating a Conceptual Representation of a Legacy Web Application
Roberto Rodríguez-Echeverría, Víctor M. Pavón, Fernando Macías, José M. Conejero, Pedro J. Clemente, Fernando Sánchez-Figueroa
*International Conference on Web Information Systems Engineering*, 2013. DOI: 10.1007/978-3-642-41154-0_17

## Project deliverables and technical reports

[1] Testing Embedded Software – State of the Art and State of the Practise
Fernando Macías, César Sánchez, Alessandra Gorla, José F. Morales
MFoC project deliverable, IMDEA Software Institute, 2020

[2] The Category of Typing Chains as a Foundation of Multilevel Typed Model Transformations
Uwe Wolter, Fernando Macías, Adrian Rutle
Tech. rep., University of Bergen, Department of Informatics, 2019

## Presentations

[1] MFoC Progress Report – Automatic V&V Techniques
MFoC Progress Meeting, Madrid, Spain, 18 Nov 2019

[2] Multilevel Modelling and Domain-Specific Languages
Software Seminar Series (S3) at IMDEA Software Institute, Madrid, Spain, 29 Oct 2019

[3] Empowering Multilevel DSMLs with Integrated Runtime Verification
VORTEX 2019, part of ECOOP 2019, London, United Kingdom, 19 Jul 2019

[4] A Tool for the Convergence of Multilevel Modelling Approaches
MULTI 2018, part of MODELS 2018, Copenhagen, Denmark, 16 Oct 2018

[5] Towards rearchitecting meta-models into multi-level models
ER 2017, Valencia, Spain, 7 Nov 2017

[6] Towards an Autonomous Robot Architecture Combining Complex Event Processing and Multilevel Modelling
NWPT 2017, Turku, Finland, 1 Nov 2017

[7] Coordination and Amalgamation of Multilevel Coupled Model Transformations
NWPT 2017, Turku, Finland, 1 Nov 2017

[8] Changing the way we program robots
Opening of the Computer Science PhD Programme at the ICT Engineering Department, Bergen, Norway, 3 Oct 2017

[9] Multilevel Modelling with MultEcore: A Contribution to the MULTI 2017 Challenge
MULTI 2017, part of MODELS 2017, Austin, Texas, USA, 19 Sep 2017

[10] Multilevel Modelling with MultEcore
University of Extremadura, Cáceres, Spain, 8 May 2017

[11] Why I travelled over 2000 km to do a PhD
ICT Engineering Department Annual Seminar, Osterøy, Norway, 5 Apr 2017

[12] Describing Behaviour Models through Reusable, Multilevel, Coupled Model Transformations
NWPT 2016, North Jutland, Denmark, 1 Nov 2016

[13] Multilevel Behavioural Metamodelling
NWPT 2016, North Jutland, Denmark, 1 Nov 2016

[14] MultEcore: Combining The Best of Fixed-Level and Multilevel Metamodelling
MULTI 2016, part of MODELS 2016, Saint-Malo, France, 4 Oct 2016

[15] On Reducing Model Transformation Testing Overhead
VOLT 2016, part of MODELS 2016, Saint-Malo, France, 2 Oct 2016

[16] Solving the CRA problem with simulated annealing implemented in Java and ATL
TTC 2016, part of STAF 2016, Vienna, Austria, 8 Jul 2016

[17] Runtime Verification of Executable Models
NWPT 2015, Reykjavík, Iceland, 22 Oct 2015

[18] Formalización de Modelos de Comportamiento
JCSD 2015, Málaga, Spain, 11 Jun 2015

[19] RSL: Revisión Sistemática de Literatura ó Reading Spooky Lots
University of Extremadura, Cáceres, Spain, 26 Sep 2014

[20] Proceso de verificación de reglas de transformación basado en métricas
JISBD 2014, Cádiz, Spain, 17 Sep 2014

[21] Herramienta de soporte en procesos de modernización, para las fases de ingeniería inversa y reestructuración
JISBD 2014, Cádiz, Spain, 17 Sep 2014

[22] Generación dirigida por modelos de una API REST para una aplicación Web heredada
JISBD 2013, Madrid, Spain, 18 Sep 2013

[23] Model-Driven Generation of a REST API from a Legacy Web Application
MDWE 2013, part of ICWE 2013, Aalborg, Denmark, 10 Jul 2013