

## CURRICULUM VITAE

### Part A. PERSONAL INFORMATION

CV date

31/01/2024

First name	Adrián		
Family name	Amor Martín		
Gender (*)	Male	Birth date	17/05/1989
ID number	47486795Y		
e-mail	<a href="mailto:aamor@ing.uc3m.es">aamor@ing.uc3m.es</a>	URL Web	<a href="https://aamorm.github.io/">https://aamorm.github.io/</a>
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#### A.1. Current position

Position	Profesor Ayudante Doctor		
Initial date	01/02/2021		
Institution	Universidad Carlos III de Madrid		
Departament	Teoría de la Señal y Comunicaciones		
Country	España	Teleph. number	661371641
Key words	Computational Electromagnetics, High-Performance Computing, Geophysics, Microwave Imaging		

#### A.2. Previous positions

Period	Position/Institution/Country
2019-2020	Postdoctoral Fellow, Saarland University, Germany
2015-2018	FPU scholarship holder, University Carlos III of Madrid, Spain
2014-2015	PIF scholarship holder, University Carlos III of Madrid, Spain

#### A.3. Formación Académica

PhD, Licensed, Graduate	University/Country	Year
Doctorado en Multimedia y Comunicaciones	Universidad Carlos III de Madrid	2018
Máster en Multimedia y Comunicaciones	Universidad Carlos III de Madrid	2014
Ingeniero de Telecomunicación	Universidad Carlos III de Madrid	2012

### Parte B. CV SUMMARY

My primary research interest lies in the field of **computational electromagnetics** (CEM) and lately I have also been engaged in **interdisciplinary research** collaborating with international groups in **physics, mathematical modeling, heterogeneous computing, and geophysics**. Regarding CEM, I have made **substantial contributions** to the development of a code based on the **Finite Element Method** (FEM) which focuses on **High-Performance Computing** (HPC) technologies, with significant contributions to the development of **new curl-conforming basis functions** for different element shapes (tetrahedra, triangular prisms, hexahedra) to approximate the electromagnetic fields and **parallelization techniques** to tackle **large-scale simulations** (e.g., **Domain Decomposition Methods**, DDM). These contributions are the core of **high-impact publications**, a **national research project** (TEC2016-80386-P), one **PhD thesis** I tutored in 2020, and an **ongoing private contract** funded by **AIRBUS** from 2022 where I am part of the research team.

Lately, I have benefited from my experience with **antenna measurements** (as the **laboratory coordinator** for antenna certification with Telefónica, see C.4) to being involved in the **design and manufacturing of sensors and antennas for microwave imaging and non-destructive testing**, tutoring **one ongoing PhD thesis, three MSc, and two BSc theses**. In the years to come, I will use my CEM background to solve the so-called **inverse problem** (focusing on the new possibilities brought by **Artificial Intelligence**) using the measurements provided by these manufactured circuits. This problem is very **demanding** from the computational perspective to be deployed in **real-time applications** (needed in the industry), so I joined forces with Dr. Belloch and explored the potential of new HPC paradigms such as **heterogeneous computing**. This research line has led to getting funding as **Principal Investigators for two public research projects** (national and regional) in 2022 and 2023



and the interest in this project for the industry made us get a **private contract** funded by Arquimea in 2023.

I have been a **postdoctoral** researcher at **Saarland University** with Prof. Dyczij-Edlinger for **two years** (where I grew as an autonomous researcher, collaborating with PhD students to develop new curl-conforming basis functions producing **two Q1 papers**), with whom I continue to collaborate (six papers to be submitted). I have been funded in competitive calls to do **two stays** to go to the **Politecnico di Torino** (May 2023) and **Pontificia Universidad Católica del Perú** (July 2023), where I started collaborations in **microwave imaging**. During my Ph.D., I was also **funded to visit** the University of Macau for two months (working in an international group to develop specific parts of the HPC-enabled FEM code and producing a Q4 paper), and the **ElectroScience Laboratory** (Ohio) under the direction of Prof. Jin-Fa Lee for seven months in two different stays (where I further characterized the accuracy of DDM, and produced a **Q1 paper**).

Also, I have disseminated the results of my research at well-known conferences (12 in the last year), where I noticed the absence of a **standard benchmark** to compare different CEM solvers; so, I published in open access a testbench of arbitrary accuracy, and I enrolled in the **Working Group P2816 APS/SC/CEM of the IEEE**, devoted to writing a recommended practice for computational electromagnetics applied to modeling and simulation of antennas. I also serve regularly as a **reviewer** in reference journals on signal processing, supercomputing, and microwave fields, and I am an **IEEE Senior Member** from 2023.

Since receiving one of the **start-up awards** in 2012 (with an **HPC project**), I am also committed to the **scientific and social impact** of my research, either through **transfer or dissemination activities**. Since 2020, I have been the **coordinator** of an active working group (**GT Jóvenes**) at the Spanish Professional College of Telecommunication Engineers (**COIT**), where I have co-founded a **mentoring program** (**ment-it**, now in its fourth edition with more than a hundred engineers connected) that gives **professional advice** to young engineers. In the same vein, I am the **Principal Investigator** of an **outreach plan** where I created the **Ambassadors program** aimed at promoting **STEAM careers** and **reducing the gender gap** in our field. I have promoted young careers by being part of the **national committee** of **URSI**.

Quantitatively, I have authored or co-authored **22 JCR-indexed papers** (eight Q1, nine Q2, four Q3, and one Q4) and **45 conference contributions**. I have **one six-year research period** (2015-2020). Also, I am the **Principal Investigator (PI)** of a regional public research project (where we **hired** three graduate students, 60,000€), a national public research project (42,000€), a private research contract (60,500€), and a public promotion project (250,000€). I have been part of the team in **7 research projects** and **10 private contracts**, and I have tutored **one PhD, four MSc, and two BSc theses**.

## Parte C. RELEVANT MERITS.

### C.1. Publications

1. Belloch, J.A.(CA); Coronado, R.; Valls, Ó.; Piñero, G. 8/9. 2024. "Urban Sound Classification using Neural Networks on Embedded FPGAs." The Journal of Supercomputing. No assigned volume yet. JCR impact factor: 3.3, **Q2** (2022).
2. **Amor-Martín, A. (CA)**, García-Castillo, L. E. 2023. "Second-Order Nédélec Curl-Conforming Hexahedral Element for Computational Electromagnetics." IEEE Transactions on Antennas and Propagation. Vol. 71: 859–868. JCR impact factor: 5.7, **Q1** (2022).
3. Toth, L.L.; **Amor-Martín, A.**; Dyczij-Edlinger, R. (CA). 2023. "Hierarchical Universal Matrices for Curvilinear Tetrahedral H(curl) Finite Elements with Inhomogeneous Material Properties." IEEE Transactions on Antennas and Propagation. No assigned volume yet. JCR impact factor: 5.7, **Q1** (2022).
4. **Amor-Martín, A. (CA)**; García-Castillo, L.E.; Toth, L.L.; Floch, O.; Dyczij-Edlinger, R. 2023. "A Rigorous Code Verification Process of the Domain Decomposition Method in a Finite Element Method for Electromagnetics." IEEE Transactions on Antennas and Propagation. No assigned volume yet. JCR impact factor: 5.7, **Q1** (2022).
5. Falcón-Gómez, E.; De Falco, V.; Atia-Abdalmalak, K.; **Amor-Martín, A.**; De La Rubia, V.; Santamaría-Botello, G.; García-Muñoz, L.E. (CA). 2023. "Interaction between linear polarized



- plane gravitational waves and a plane electromagnetic wave in the electromagnetic-gravity analogue.” *Physical Review D*. Vol. 107:124042. JCR impact factor: 5.0, **Q1** (2022).
6. Badía, J. M.; **Amor-Martín, A. (CA)**; Belloch, J. A.; García-Castillo, L. E. 2022. “Strategies to parallelize a finite element mesh truncation technique on multi-core and many-core architectures.” *The Journal of Supercomputing*. Vol. 79: 7648–7664. JCR impact factor: 3.3, **Q2**.
  7. Castillo-Reyes, O. (CA); **Amor-Martín, A.**; Botella, A.; Anquez, P.; García-Castillo, L. E. 2022. “Tailored meshing for parallel 3D electromagnetic modeling using high-order edge elements.” *Journal of Computational Science*. Vol. 63:101813. JCR impact factor: 3.3, **Q2**.
  8. **Amor-Martín, A. (CA)**; Garcia-Castillo, L. E.; Lee, J.-F. 2021. “Study of Accuracy of a Non-Conformal Finite Element Domain Decomposition Method”. *Journal of Computational Physics*. Vol. 429:109989. JCR impact factor: 4.645, **Q1**.
  9. Martínez-Fernández, I.; **Amor-Martín, A. (CA)**; Garcia-Castillo, L. E. 2021. “Test-Driven Development of a Substructuring Technique for the Analysis of Electromagnetic Finite Periodic Structures.” *Applied Sciences*. Vol. 11(24): 11619. JCR impact factor: 2.838, **Q2**.
  10. González-Serrano, F. J. (CA); Navia-Vázquez, Á.; **Amor-Martín, A.** 2017. “Training Support Vector Machines with Privacy-Protected Data.” *Pattern Recognition*. Vol. 72: 93–107. JCR impact factor: 3.965, **Q1**.
  11. **Amor-Martín, A. (CA)**, García-Castillo, L. E; Garcia-Donoro, D. 2016. “Second-Order Nédélec Curl-Conforming Prismatic Element for Computational Electromagnetics.” *IEEE Transactions on Antennas and Propagation* Vol. 64: 4384–4395. JCR impact factor: 2.957, **Q1**.

## C.2. Congress

1. **Amor-Martín, A.**; Garcia-Castillo, L. E. “On the Validation of Curl-Conforming Higher-Order Basis Functions using the Method of Manufactured Solutions.” Oral presentation, invited paper. 24th International Conference on Electromagnetics in Advanced Applications (**ICEAA**), 10 Oct. 2023, Venice, Italy.
2. Llorente-Romano, S.; Garcia-Castillo, L. E.; **Amor-Martín, A.** “Numerically Stable Implementation of Ewald Method for 1D Periodicity.” Oral presentation. XV Encuentro Ibérico de Electromagnetismo Computacional (**EIEC**), 15 Nov. 2023, Cádiz, Spain.
3. **Amor-Martín, A.**; Garcia-Castillo, L. E. “A Priori Verification Method for Curl-Conforming Vector Functions in Simplices.” Oral presentation. 23rd International Conference on Computational and Mathematical Methods in Science and Engineering (**CMMSE**), 4 Jul. 2023, Cádiz, Spain.
4. Falcón, E.; Atia-Abdalmalak, K.; **Amor-Martín, A.**; González-Jiménez, A.; de la Rubia, V.; Santamaría-Botello, G.; De Falco, V.; García-Muñoz, L. E. “Analogous Electromagnetic Wave Propagation in a Schwarzschild Black Hole Space-time Using Parallel Conducting Surfaces Waveguides.” Oral presentation. 17th European Conference on Antennas and Propagation (**EuCAP**), March 2023, Florence, Italy. **Nominated to Best Paper Award** in Electromagnetics.
5. Santiago-Mesas, S.; Fernández-Aranzamendi, E.; Segovia-Vargas, D.; **Amor-Martín, A.**; González-Posadas, V. “A High-Stability and High-Sensitivity Active Sensor for Non-Invasive Breast Cancer Detection.” Oral presentation. 53rd European Microwave Conference (**EuMC**), 20 Sep. 2023.
6. Santiago-Mesas, S.; **Amor-Martín, A.**; Segovia-Vargas, D.; González-Posadas, V. “Precise Active Sensor Design for Monitoring in Biological and Industrial Applications.” Oral presentation. 52nd European Microwave Conference (**EuMC**), 27 Sep. 2022.
7. Toth, L. L.; **Amor-Martín, A.**; Dyczij-Edlinger, R. “Convergence Study of H(curl) Serendipity Basis Functions for Hexahedral Finite-Elements.” Oral presentation. Invited paper. 24<sup>th</sup> International Microwave and Radar Conference (**MIKON**). 12 Sep. 2022, Gdansk, Poland.
8. **Amor-Martín, A.**; Toth, L. L.; Dyczij-Edlinger, R. “H(Curl)-Conforming Hierarchical Basis Functions on Prisms and Hexahedra.” Oral presentation. Kleinheubacher Tagung (**KH**). 23 Sep. 2019, Miltenberg, Germany.
9. **Amor-Martín, A.**; Garcia-Castillo, L. E.; Garcia-Donoro, D. “Towards a Scalable Hp Adaptive Finite Element Code Based on a Nonconformal Domain Decomposition Method.” Oral presentation. 48th European Microwave Conference (**EuMC**), 24 Sep. 2018, Madrid, Spain.
10. Garcia-Donoro, D.; Ting, S.W.; **Amor-Martín, A.**; Garcia-Castillo, L. E. “Higher order finite element method solver for the analysis of microwave devices in planar technology.” Oral presentation. 46th European Microwave Conference (**EuMC**), 4 Oct. 2016, London, UK.



### C.3. Research projects

1. PID2022-137048OA-C43. STARRING-IMPLE, “Spatial Audio and Array Processing for Industrial Applications and Digital Transformation: Efficient Implementations Through Parallel and Approximate Computing.” Proyectos de Generación de Conocimiento, Ministerio de Ciencia e Innovación. **Adrián Amor Martín**, José A. Belloch-Rodríguez. 01/09/2023-31/08/2026. 42,000 €. **Principal Investigator**. I use my expertise in HPC and mathematical modelling to develop new approaches for the algorithms that will be tested in the coordinated project.
2. 2022/00024/001. MIMACUHSPACE-CM, “Microwave Materials Characterization Using Heterogeneous Systems-on-Chip for the Space Environment.” Comunidad de Madrid. Convocatoria Proyectos Interdisciplinarios de I+D - Jóvenes doctores/as Convenio plurianual CM-UC3M. **Adrián Amor Martín**, José A. Belloch-Rodríguez. 01/01/2022-31/12/2023. 60,000 €. **Principal Investigator**. I lead all the tasks related to material characterization with a FEM code using HPC infrastructures.
3. TSI-063000-2021-150. PPET, “Plan de Promoción de Estudios de Telecomunicación.” Ministerio de Asuntos Económicos y Transformación Digital. Convocatoria UNICO-5G I+D: Programa de Universalización de Infraestructuras Digitales para la Cohesión – 2021. **Adrián Amor Martín**. 01/01/2022-31/12/2024. 250,000€. **Principal Investigator**. I coordinate all the tasks at the UC3M, and we create a group of reference engineers, foster inter-university students’ groups, and organize events to disseminate engineering activities to attract talent into the STEAM fields. I also created the Ambassadors program to bring the experience of a telecommunications engineer to high schools.
4. TEC2016-80386-P. “Electromagnetic Simulator for HPC Environments”. Ministerio de Economía y Competitividad. Plan Nacional de I+D+I (Convocatoria EXCELENCIA). Luis E. García Castillo. 01/01/2017- 31/12/2019. 119,427 €. **Part of the working team**. The core of this project is based on my Ph.D. thesis, using algorithm-based parallelization and introducing HPC optimization in an object-oriented Fortran code.
5. TEC2010-18175/TCM, “Análisis de Estructuras Periódicas Finitas Regulares e Irregulares mediante Técnicas de Descomposición de Dominios en Paralelo con Adaptatividad hp Automática”. Ministerio de Ciencia e Innovación. Plan Nacional de I+D+I. Luis E. García Castillo. 01/01/2012-31/12/2014. 168,432 €. **Part of the working team**. I contributed to the study of the DDM approach and developed basis functions (together with adaptive strategies for triangular prisms).

### C.4. Contracts, technological or transfer merits

1. SPACECAR: Caracterización de materiales mediante tecnología de microondas usando sistemas embebidos heterogéneos para el entorno espacial. Arquimea. **Adrián Amor Martín**, José A. Belloch-Rodríguez. 25/04/2023-20/12/2023. 60,500 €. **Principal Investigator**. I develop algorithms for material characterization using microwave radiation in harsh environments.
2. Integration and Industrialization of FEM Solutions for Computational Electromagnetics. Airbus Defence and Space, S.A.U. Luis E. García Castillo. 13/05/2022-03/03/2024. 107,000 €. **Researcher**. I am one of the three researchers in the working team and develop codes based on the implementation of new basis functions, new boundary conditions, and equivalent problems.
3. INDRA-UC3M chair in radiofrequency technologies. Indra Sistemas, S.A. Daniel Segovia Vargas (UC3M). 26/10/2021-26/10/2023. 29,011.76 €. **Part of the working team**. I am an academic tutor who coordinates students’ work with Indra’s goals.
4. Antenna measurement from different manufacturers with Starlab Satimo given by Telefónica. Telefónica. Daniel Segovia Vargas (UC3M). From 01/06/2014. Around 343,269.04 €. **Researcher**. Coordinator for the measurements part and collaboration with Telefónica in the development of Matlab libraries based on standards (BASTA).