Ángel Rodríguez-Rozas

PH.D. IN COMPUTATIONAL ENGINEERING AND APPLIED MATHEMATICS · COMPUTATIONAL MATHEMATICIAN EXPERT
Passionate analytical thinker and solution-driven computational & applied mathematician with
15+ years' experience advising and delivering efficient simulation software in industrial domains & scientific research

Education

- **Ph.D. in Computational Engineering and Applied Mathematics**, Universidade de Lisboa, Portugal, 2012

Dissertation's title: *Highly Efficient Probabilistic-Based Numerical Algorithms for Solving Partial Differential Equations on Massively Parallel Computers*

- **MSc in Computer Science - Artificial Intelligence**, Polytechnic University of Catalonia (UPC), Barcelona, Spain, 2008

Outstanding Graduate Student Award (9.6 out of 10)

Thesis in parallel numerical methods: *Development of Highly Efficient Algorithms in Parallel Scientific Computing*

- **BSc in Computer Science**, University of Rovira i Virgili, Tarragona, Spain, 2006

Outstanding Graduate Student Award (9.3 out of 10)

Thesis' in Artificial Intelligence: *Parallel Execution of Complex Tasks Using a Distributed, Robust and Flexible Agent–Based Platform*

Work experience

- **Banco Santander**, Madrid, Spain

  Role: **Quant Analyst Model Validation - Corporate Risk Division**, as

  - 2023 – *Present* | **Expert**
  - 2022 | **Specialist III**
  - 2021 | **Specialist II**
  - 2018 – 2020 | **Associate director**

  ♦ Project Leading: design and development of a new software library written in Python and C++, for the validation of Front Office pricing models (+20 persons involved from 4 different teams working for the project, from Spain and UK).
  ♦ Internal Master on Business and Technology at Banco Santander (1st generation, selected among 100 employees across the entire corporate Group).

- **CUNEF**, Madrid, Spain

  Jan 2024 – *Present* – **Professor**, *part-time* (Dept. of Quantitative Methods)

- **Afi Escuela de Finanzas**, Madrid, Spain

  Feb 2022 – *Present* – **Recurrent Invited speaker** (specialized subjects within Finance Master programs)

- **IQM Quantum Computers**, Espoo, Finland; Munich, Germany; Bilbao, Spain (working remotely)

  May 2021 – Feb 2023 - **External Consultant (freelance)**

- **BCAM – Basque Center for Applied Mathematics**, Bilbao, Spain

  Jan 2017 – Mar 2018 - **Research Fellow**

  Jan 2015 – Jan 2017 - **Postdoctoral Researcher** (Juan de la Cierva – Spanish nation-wide grant in Mathematics)

  Nov 2014 – Jan 2015 - **Research Visitor**

- **University of Basque Country (UPV/EHU)** / **BCAM – Basque Center for Applied Mathematics**, Bilbao, Spain

  Jan 2015 – Jan 2017 - **Postdoctoral Researcher** (Juan de la Cierva – Spanish nation-wide grant in Mathematics)

- **Instituto Superior Tecnico (IST)** and **CEMAT**, Lisbon, Portugal

  Nov 2008 – Nov 2012 - **Research Assistant** (Fundaçao para a Ciencia e a Tecnologia (FCT) research grant for PhD studies)

- **University of Rovira i Virgili**, Dept. of Mathematics and Computer Science, Tarragona, Spain

  Sep 2006 – Oct 2008 - **Teaching Assistant** in Bacherlor's degrees (BSc in Computer Science, BSc in Chemistry)

Research interests and expertise

- Financial modelling and risk management.
- Quantum Computing algorithms and technologies for the finance industry.
- Developing efficient numerical methods based on Monte Carlo and on the Finite Element Method (FEM) (several industrial domains).
- Big Data/Data Science/Statistical Computing, High Performance Computing (HPC) and efficient design of software libraries.
- Industry and Academy knowledge transfer.
- Worked in the following areas: Petroleum-Engineering (Reservoir Exploration) industrial problems, Seismology (Location Recovery), Inverse problems in Geophysics, Domain Decomposition methods based on Monte Carlo, Artificial Intelligence, and High-Performance Computing (shared memory, distributed memory, GP-GPUs).

Skills/Experience

- **Quantitative finance**:
  ‣ ***Leading the design and development of a new software library written in Python and C++, for the validation of Front Office pricing models*** including the following asset classes: Interest Rates, FX, Credit, Commodities, Equity, Inflation, and xVA. It includes a Monte Carlo and a PDE engine based on the Finite Element Method and Finite Differences.
  ‣ ***Validation of Interest Rate and FX pricing models for financial derivatives***, including: Mortgages-Backed Securities (MBS), Balance Guaranteed Swaps (BGS), HJM model and calibration, IR Swaps/Swaptions/Caps-Floors products, Cross-Currency Swaps, FX Compound, FX sensitivities for the P&L, Local Volatility model, Stochastic Local Volatility (SLV) model, Markov-functional model for pricing of caps and digitals, IR/FX curves construction/calibration in the multi-curve framework, etc.
  ‣ ***Automation of all kinds of information processes*** related to the main tasks around internal validation, such as documentation processes, recommendations management, reporting tasks, project management, etc.
  ‣ ***Research to explore key areas in quantitative finance***:
    - Exploring **Quantum Computing** algorithms and technologies for the finance industry. Two papers published (see below) and two ongoing papers.
    - Exploring efficient numerical algorithms for financial models based on jump processes (Levy Flights). Ongoing research.
    - Exploring **Finite Element Methods** for the efficient simulation of pricing models. One ongoing paper.
- **Applied and Computational Mathematics expertise:** Monte Carlo, Pseudo- and Quasi-Random Number Generation, Stochastic Differential Equations (SDEs), Finite Elements, Interpolation, Extrapolation, Numerical Linear Algebra (Direct and Iterative solvers), Ordinary Differential Equations (ODEs), Partial Differential Equations (PDEs), Finite Differences, Particle-in-Cell Methods, Least Squares, Optimization, Series and Recurrences, Differentiation, Integration, Graph Partitioning.
- **Programming languages**: Python (very deep knowledge), C/C++ (very deep knowledge), Cython, Fortran 77/95/2000 (very deep knowledge), VBA, Mathematica (very deep knowledge), Matlab, Maple, Cuda–C and OpenCL for GP–GPU, MPI (very deep knowledge), OpenMP, hybrid MPI–OpenMP, POSIX Threads, Data Structures (very deep knowledge), Concurrency (very deep knowledge), Real-Time, Shell scripting, Java (very deep knowledge).
- **Other programming/markup languages and IT-related technologies**: Docker, Java for Android, Ada/Ada95, Visual Basic, x86 Assembly, PowerPC Assembly, Lisp, C–Lisp, Jade (Agents and Multi–Agent Systems paradigm), Haskell, XML, XSLT, HTLM, JavaScript, ActionScript (Flash), JSP and Servlets, PHP, Corba, RMI, XML–RPC, Flex, Bison, OpenGL, Unix Shell and Shell Scripting, Berkeley Sockets, Oracle and PL–SQL, MySQL, Microsoft SQL–Server.
- **Scientific Computing packages/solvers**: Trilinos (variety of direct and iterative solvers with preconditioners), PETSc, Scalapack, Lapack, Blas, MUMPS, SuperLU, Metis, Parmetis, Intel Adaptive Spike–Based Solver, Paraview, VTK, GNU Plot, Grace, R (Statistics), SPSS, SPRNG.
- **Finite Element Method (FEM) simulation software/libraries**:
  - ○ ***Experience in leading the design and development of FEM libraries*** for fluid-structure interaction in Seismology, and for Petroleum engineering applications for borehole resistivity measurements.
  - ○ ***Experience with 3rd-party FEM packages***: FeniCS, Gmsh, FreeFem++, SPECFEM.
- **Large experience managing/using HPC facilities:** Use of Marenostrum supercomputer (BSC - Barcelona Supercomputing Center) up to 1024 CPUs, Matrix supercomputer (CASPUR - Rome), Enigma supercomputer (IST – University of Lisbon).
- **Operating Systems**: UNIX/Linux, Mac OS X, OpenBSD, RT–Linux, Microsoft Windows.

Project lead – Software libraries coordination and development (big projects only)

- **FIRE: Project leader (+20 persons from 4 different teams working for the project, from Spain and UK)**
  - **Description:** A software library written in Python and C++, designed and developed from scratch in order to replace former disjoint libraries within Internal Validation. The library is used to validate Front Office pricing models including the following asset classes: Interest Rates, FX, Credit, Commodities, Equity, Inflation, and xVA. It includes both a Monte Carlo and a PDE engine based on the Finite Element Method and Finite Differences.
  - **Models:** Standard estimation/discount models for linear products (Swaps, Forwards, Cross-currency Swaps), Shifted-Lognormal BS model for many vanilla products (Caps/Floors, Swaptions), Hull&White, LGM (Bermudan swaption), Markov Functional, HJM for 1 and 2 strikes, BGS infrastructure for securitizations (MBS pass-through deals, Collaterlized-Debt Obligations, pool profiling, CPR and default models, Waterfall), Local Volatility and Stochastic Local Volatility models (MC, PDE with Crank-Nicolson and ADI discretizations).
  - **Components:**
    - The core of the library: market, curves, volatility surfaces/cubes, numerical integration, interpolation, PDE solvers, Monte Carlo solvers.
    - Other modules: asset classes, products, pricing engines, models, net (socket communication/interoperability with Excel).
- **pFEM (47000+ lines, 11 persons working in the project, contribution ~75% to the kernel (core of the library))**
  - **Description:** A Finite Element package for frequency-domain multiphysics problems, based on tensor-product elements with arbitrary polynomial order discretization using hierarchical basis functions. The package supports mixed H1, Hcurl, Hdiv, and L2 finite element formulations on which Multiphysics problems are easily implemented and solved. Generic treatment for 1D, 1.5D, 2D, 2.5D, and 3D problems tackled.
  - **Equations:** Frequency-domain Maxwell's, Helmholtz, Elastic and Acoustic Wave, and Poisson equations.
  - **Applications/Modelling:** Petroleum-engineering: Logging-While-Drilling and Deep Azimuthal Borehole Resistivity Measurements, Magnetotellurics, Digital Rock Physics
- **pFEM-WAVES (14000+ lines, contribution around 100%)**
  - **Description:** As pFEM, a Finite Element platform adapted to time-domain problems and inversion.
  - **Equations:** Time-domain Acoustic and Elastic equations.
  - **Applications/Modelling:** Seismology, Source-Time-Reversal problems, Digital Rock Physics
- **RelyOn (12000 lines, contribution 100%)**
  - **Description:** A Finite Element package for non-conforming time-domain acoustic-elastic coupled problems in 2D, based on Lagrangian basis functions and curved elements. Arbitrary domains meshed with Gmsh based on triangles.
  - **Equations: Time-domain Acoustic and Elastic wave equations and coupled elastoacoustics.**
  - **Applications/Modelling**: Seismology, Source-Time-Reversal problems.
- **PDD (20000+ lines, contribution 100%)**
  - **Description:** A Probabilistic Domain Decomposition (PDD) package based on the generation of random diffusion processes and characteristic curves for the numerical solution of large-scale computational problems.
  - **Equations:** Heat equation (reaction-convention-diffusion problems), transport and Vlasov-Poisson equations, Black-Sholes.
  - **Applications/Modelling**: Heat transfer problems and Plasma Physics (Tokamak Fusion Reactor).

Publications and presentations summary

- 20+ publications (mostly in ISI-peer reviewed journals), 200+ citations, h-index 10. Full list constantly updated: https://scholar.google.es/citations?hl=es&user=6g7374QAAAAJ&view_op=list_works
- 60+ presentations in international conferences, universities, research centers and companies. See below.
- Co-author of European patent application No. 20382822.3.

Funding

- 2018-2022, **Co-PI at BCAM**, €765,000: RISE MATHROCKS Project -H2020 Programme - (PI: Dr. Pardo)
- 2018, **PI at BCAM** on an extension of the contract with BCAM, the University of the Basque Country (UPV/EHU) and the Department of Petroleum and Geosystems Engineering at the University of Texas at Austin
- 2015-2017, **Co-PI at BCAM**, €580,500: RISE GEAGAM Project -H2020 Programme - (PI: Dr. Pardo)
- 2017-Present, **PI at BCAM**, contract with Repsol, S.A. Contract terms are confidential. (PI's: Dr. Pardo and A. Rodríguez-Rozas)

Students (co-)supervision

- **Postdoctoral fellows**: Julen Álvarez-Aramberri (2017-2018, BCAM), Javier Omella (2017-2018, BCAM), Magdalena Strugaru (2017-2018, BCAM), Vincent-Darrigrand (2017-2018, BCAM).
- **Ph.D. students**: Javier Gonzalez Conde (2019-present, UPV/EHU), Mostafa Shahriari (2015-2018, BCAM), Vincent Darrigrand (2014-2017, BCAM).
- **Master students**: Pedro Gonçalves (2011-2012, IST - U. Lisbon), Martín Zapata Martínez (2021-Present, U. de la Coruña/Banco Santander).
- **Undegraduate students**: Fabio Fesser (2017, BCAM).

Research visits

- 2017, **MIT Mathematics Deptartment, MIT**, Cambridge, MA, USA, **invited by Dr. Carlos Pérez-Arancibia**, 2 weeks
- 2017, **Petroleum & Geosystems Engineering Dept., The University of Texas at Austin**, Austin, TX, USA, **invited by Dr. Carlos Torres-Verdín**, 1 month, November 2017
- 2017, **Petroleum & Geosystems Engineering Dept., The University of Texas at Austin**, Austin, TX, USA, **invited by Dr. Carlos Torres-Verdín**, 2 months, July and August 2017
- 2016, **Petroleum & Geosystems Engineering Dept., The University of Texas at Austin**, Austin, TX, USA, **invited by Dr. Carlos Torres-Verdín**, 2 months
- 2015, **Petroleum & Geosystems Engineering Dept., The University of Texas at Austin**, Austin, TX, USA, **invited by Dr. Carlos Torres-Verdín**, 2 months
- 2014, **Basque Center for Applied Mathematics**, Bilbao, Spain, **invited by Dr. David Pardo**, 2 months
- 2012, **Parallel Algorithms Group, CERFACS**, Toulouse, France, **invited by Dr. Xavier Vasseur**, founded by HPC–Europe2 project, 5 weeks
- 2011, **Department of Computer Architecture, Polytechnic University of Catalonia**, Spain, **invited by Dr. José–Ramón Herrero**, 2 weeks
- 2011, **Department of Mathematical Sciences, Carnegie Mellon University**, USA, **invited by Dr. Gautam Iyer**, 3 weeks
- 2010, **Department of Mathematics, Università Degli Studi Roma Tre**, Italy, **invited by Dr. Renato Spigler**, 4 weeks
- 2010, **Institute of Computational Engineering and Sciences (ICES), University of Texas at Austin**, Austin, TX, USA, **invited by Dr. Thomas J. R. Hughes**, 4 weeks
- 2009, **Department of Mathematics, Università Degli Studi Roma Tre**, Italy, **invited by Dr. Renato Spigler**, 3 weeks
- 2008, **Department of Mathematics, Università Degli Studi Roma Tre**, Italy, **invited by Dr. Renato Spigler**, 2 weeks

Teaching experience

- o **Invited speaker** at *Brain&code*, about structured and object-oriented programming (2023)
- o **Invited masterclass** at *Afi Escuela de Finzas*, about Quantum Computing in Banking and Finance (2022 and 2023).
- o **Invited speaker** at *Banco Santander' Young Leaders program*, about Quantum Computing in Banking and Finance (2023).
- o **Python course** at *Banco Santander*, Introductory course to Python instructed within the Risk division (several times 2019-2021).
- o **Coding the Finite Element Method (FEM) II** at *BCAM*, one-week course instructed at El Cajón del Maipo, Chile, within the GEAGAM

European research network' activities, January 16-20, 2017
- o **Coding the Finite Element Method (FEM) with Geophysical Applications** at *BCAM*, one-week course, within the GEAGAM European research network' activities, Bilbao, Spain, May 17-20, 2016
- o **Coding the Finite Element Method (FEM) with Geophysical Applications** at *BCAM*, one-week course delivered at the University of Pau et les Pays de l'Adour (UPPA), within the GEAGAM European research network' activities. Pau, France, May 18-22, 2015
- o **Assistant Professor, BSc in Computer Science's courses** at *University of Rovira I Virgili of Tarragona*, 2006-2008 (two academic years). Courses:
  - o Computer Structure (computer labs.), 2006-2007, 2007-2008
  - o Programming Language II (theory and computer labs.), 2006-2007, 2007-2008
  - o Introduction to Programming (theory and computer labs.), 2007-2008

Research grants and awards

- Jan 2015 – Jan 2017, **Spanish national Postdoctoral research grant (Juan de la Cierva) in Mathematics**, by Ministry of Economy and Competitiviness (MINECO) of Spain. Ref. no. FPDI–2013–17098. Rate of acceptance: 6 grants awarded nationwide in the field of Mathematics
- June 2016, grant for attending the **KI-Net Summer School on Quantum and Kinetic Theory for Complex Systems** held at the **University of California - Santa Barbara**, by Department of Mathematics from June 13-17, 2016
- 2014, **ICOSAHOM 2014 Travel Award**, ICOSAHOM Organization (Salt Lake City, Utah, USA)
- Nov 2008 – Nov 2012, **PhD grant (4 years)**, by The Portuguese National Science Foundation (FTC). Ref. no. SFRH/BD/45362/2008 Rate of acceptance: 15 grants awarded nationwide in the field of Computational Sciences
- Jun – Jul 2012, **HPC–Europe2 grant**, by HPC–Europe2 European project. Visiting CERFACS within the GENCI–CINES French node
- 2011, grant for attending **the 12th Workshop on the DOE Advanced CompuTational Software (ACTS) Collection**, Scalable and Robust Computational Tools for High–End Computing, Aug 16—19, by **Lawrence Berkeley National Laboratory at University of California, Berkeley, and Department of Energy (DoE)**, USA, Rate of acceptance: around 10%
- 2011, **AMMCS 2011 Travel Award**, by The Fields Institute for Research in Mathematical Sciences (Waterloo, Canada)
- 2010, **SIAM Student Travelling Award** to attend and participate in the SIAM Annual Meeting, by SIAM (USA)
- 2010, grant for attending the **II i–Math School on Numerical Solutions of Partial Differential Equations**, Malaga, Spain, Feb. 8—12, 2010, by i–MATH ingeneo mathematica, ref. No. CSD2006–00032
- 2009, **One–week school in Advanced Computing TACC**, organized by the Texas Advanced Computing Center at UT Austin, supported by the UT Austin – Portugal program (CoLab)
- 2009, grant for attending **Robust methods and algorithms for solving large algebraic systems on modern high performance computing systems**, by INRIA Sophia Antipolis–Méditerranée, France, Mar. 30–Apr. 3, 2009
- 2009, **M.Sc. Outstanding Graduation Award**, by University Rovira i Virgili (Tarragona, Spain)
- Sep 2007 – Oct 2008, **Master Fellowship Grant**, by Dept. of Mathematics and Computer Science, University of Rovira i Virgili, Tarragona, Spain. Rate of acceptance: around 15%
- 2007, grant for attending the **Scuola Estiva di Calcolo Avanzato**, by CASPUR, Rome, Italy, Jul 2007
- 2007, grant for attending summer school course on **Supercomputing**, organized by Universidad de Málaga, June 2007
- 2007, **B.Sc. Outstanding Graduation Award**, by University Rovira i Virgili (Tarragona, Spain)
- 2004, **Fundación REDDIS Graduation Award**, by REDDIS Foundation (Reus, Spain)

Languages

English (fluent, Cambridge C1 certificate), **Spanish** (native), **Portuguese** (fluent), **French** (working level), **Catalan** (native)

Membership

- **Society for Industrial and Applied Mathematics (SIAM), Graduate Student Member**, 2009 to 2012.
- **European Association for Geophysical Exploration (EAGE)**, 2017.

Committee and other responsibilities

- Collaboration on the definition of the curricular plan for a new University grade in *Industrial Mathematics*, CEU San Pablo, Madrid (2022)
- Invited at closure event at the Young Leaders Programm in Banco Santander, Madrid (2022)
- Master in *Banca y Finanzas Cuantitativas*, invited commentator for master's thesis entitled: "Variable importance in linear regression versus random forest. Analysis over consumer loans prepayment rates.", Madrid, Spain, July 2019
- **SIAM Annual Meeting 2010**, *chair of session* CP7 - Numerical PDEs II, Pittsburgh, USA, 2010
- *Member* of the **Committee on BSc's thesis defense** entitled "Noves eines d'evaluació per a l'entorn Moodle", Dept. of Math. and Comp. Sci., University of Rovira i Virgili, Tarragona, Spain, 2008

Other interests

Portrait drawing, reading, languages, sports, nutrition, psychology, sociology, programming all kind of devices (android, iOS), cinema, CPU collector, photography, electronic gadgets and travel.

References

- **Dr. David Pardo**, Ikerbasque research professor, BCAM and UPV-EHU
  48940 Barrio Sarriena S/N, Leioa, Spain
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  E-mail: dzubiaur@gmail.com
- **Dr. Julien Diaz**, INRIA Research Scientist
  INRIA–Bordeaux–Sud–Ouest, Équipe–Project Magique3D, UFR Sciences, Bâtiment B1 Avenue de l'Université - BP 1155 64013 PAU CEDEX, France
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  DISCTE-IUL, Av. Forças Armadas 1649-026. Lisbon, Portugal
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- **Dr. Renato Spigler**, Full Professor
  Department of Mathematics University "Roma Tre" 1, Largo San Leonardo Murialdo 00146 Rome, Italy
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  E–mail: spigler@mat.uniroma3.it
- **Dr. Rui Vilela Mendes**, Senior Researcher and Member of Lisbon Academy of Sciences
  Centro de Matemática e Aplicações Fundamentais IIIUL – Universidade de Lisboa Av. Gama Pinto, 2 1649–003 Lisbon, Portugal
  Phone: +351 914 739 442
  E–mail: vilela@cii.fc.ul.pt

Patents

1. Co-author of **European patent application No. 20382822.3** with title "Quantum computer-implemented method for solving a partial differential equation".

Main Publications

1. J. Gonzalez-Conde, A. Rodríguez-Rozas, Enrique Solano, and Mikel Sanz, **Efficient Hamiltonian simulation for solving option price dynamics**, Phys. Rev. Research 5, 043220 – 2023

2. A. Rodríguez-Rozas, R. Spigler, J. Acebrón, **The PDD Method for Solving Linear, Nonlinear, and Fractional PDEs Problems**, book chapter in: Nonlocal and Fractional Operators, SEMA SEMAI Springer Series, Vol. 26, June 2021, ISBN: 978-3-030-69235-3

3. J. Gonzalez-Conde, A. Rodríguez-Rozas, E. Solano, M. Sanz, **Pricing Financial Derivatives with Exponential Quantum Speedup**, arXiv preprint arXiv:2101.04023, 2022

4. A. Martín, B. Candelas, A. Rodríguez-Rozas, J. Martín-Guerrero, X. Chen, L. Lamata, R. Orus, E. Solano, M. Sanz, **Towards Pricing Financial Derivatives with an IBM Quantum Computer**, Physical Review Research 3 (1), 013167

   * Selected by the MIT Technology Review, week's 5 best papers (week ending April 20, 2019) in "The Best of the Physics arXiv":
   https://www.technologyreview.com/s/613339/the-best-of-the-physics-arxiv-week-ending-april-20-2019/?fbclid=IwAR1P7orJm8K799V21gqiE9h4PRM3T-YYTwIuEblb1GnARy1TybporgFUe8M

5. R. Brevis, A. Rodríguez-Rozas, J. Ortega, D. Pardo, **Source time reversal (STR) method for linear elasticity**, *Computers & Mathematics with Applications*, Vol. 77 (5), pp. 1358-1375, 2019

6. A. Rodríguez-Rozas, D. Pardo, C. Torres-Verdín, **Fast 2.5D Finite Element Simulations of Borehole Resistivity Measurements**, *Computational Geosciences*, Vol. 22 (5), pp. 1271-1281, 2018

7. T. Chaumont-Frelet, D. Pardo, A. Rodriguez-Rozas, **Finite element simulations of logging-while-drilling and extra-deep azimuthal resistivity measurements using non-fitting grids**, *Computational Geosciences*, Vol. 22 (5), pp. 1161-1174, 2018

8. V. Darrigrand, A. Rodríguez-Rozas, I. Muga, D. Pardo, **Goal-Oriented Adaptivity using Unconventional Error Representations for the Multi-Dimensional Helmholtz Equation**, *International Journal for Numerical Methods in Engineering*, Volume 113, Issue 1, Pages 22–42, 2018

9. Mostafa Shahriari, Sergio Rojas, David Pardo, Angel Rodríguez-Rozas, Shaaban Bakr, Victor Calo, Ignacio Muga, **A numerical 1.5 D method for the rapid simulation of geophysical resistivity measurements**, *Geosciences*, Vol. 8 (6), 2018

10. T. Chaumont-Frelet, D. Pardo, A. Rodríguez-Rozas, **Finite Element Simulations of Logging-While-Drilling and Extra-Deep Azimuthal Resistivity Measurements using Non-Fitting Grids**, submitted to *Computational Geosciences*, on July 2017

11. M. Shahriari, A. Rodríguez-Rozas, S. Bakr, D. Pardo, **A numerical 1.5D method for the rapid simulation of geophysical resistivity measurements**, submitted to *Journal of Computational Physics,* on September 2017

12. V. Darrigrand, A. Rodríguez-Rozas, D. Pardo, I. Muga, **Goal-Oriented p-Adaptivity using Unconventional Error Representations for a 1D Steady State Convection-Diffusion Problem**, In *Procedia Computer Science*, Volume 108, Pages 848-856, ISSN 1877-0509, 2017

13. A. Rodríguez-Rozas, D. Pardo, C. Torres-Verdín, **Fast simulation of 2.5 d lwd resistivity tools**, *79th EAGE Conference & Exhibition*, París, France, 2017

14. A. Rodríguez-Rozas, David Pardo, **A Priori Fourier Analysis for 2.5D Finite Elements Simulations of Logging-While-Drilling (LWD) Resistivity Measurements**, *Procedia Computer Science*, Volume 80, Pages 782-791, ISSN 1877-0509, 2016

15. A. Rodríguez–Rozas, J. Diaz, **Non-Conforming Curved Finite Element Schemes for Time-Dependent Elastic-Acoustic Coupled Problems**, *Journal of Computational Physics*, Volume 305, Pages 44-62, ISSN 0021-9991, 2015

16. J. A. Acebrón, A. Rodríguez–Rozas, **Highly Efficient Numerical Algorithm Based on Random Trees for Accelerating Parallel Vlasov–Poisson Simulations**, *Journal of Computational Physics*, Vol. 250, 2013, 224–245, 2013

17. Ángel Rodríguez-Rozas, **Highly Efficient Probabilistic-Based Numerical Algorithms for Solving Partial Differential Equations on Massively Parallel Computers**, *PhD Dissertation*, UTL, Instituto Superior Técnico, Lisboa, 2012

18. J. A. Acebrón, A. Rodríguez–Rozas, **A New Parallel Solver Suited for Arbitrary Semilinear Parabolic Partial Differential Equations Based on Generalized Random Trees**, *Journal of Computational Physics*, Vol. 230, Issue 21, 7891–7909, ISSN 0021–9991, 2011

19. D. Sánchez, D. Isern, A. Rodríguez–Rozas and A. Moreno, **Agent–Based Platform to Support the Execution of Parallel Tasks**, *Expert Systems with Applications* 38(6): 6644–6656, 2011

20. J. Acebrón, A. Rodríguez–Rozas, and R. Spigler, **A Fully Scalable Algorithm Suited for Petascale Computing and Beyond**, *Comput. Sci. Res. Dev.*, Vol. 25, Issue 1–2, 115–121, 2010

21. J. A. Acebrón, A. Rodríguez–Rozas, R. Spigler, **On the Performance of a New Parallel Numerical Algorithm for Large–Scale Simulations of Nonlinear Partial Differential Equations**, In: Wyrzykowski, Roman and Dongarra, Jack and Karczewski, Konrad and Wasniewski, Jerzy (eds.): *Parallel Processing and Applied Mathematics, Lecture Notes in Computer Science*, Vol. 6067/2010, 41–50, 2010

22. J. Acebrón, A. Rodríguez–Rozas, and R. Spigler, **Domain Decomposition Solution of Nonlinear Two–Dimensional Parabolic Problems by Random Trees**, *Journal of Computational Physics,* Vol. 228, 2009, 5574–5591, 2009

23. J. A. Acebrón, A. Rodríguez–Rozas, and R. Spigler, **Efficient Parallel Solution of Nonlinear Parabolic Partial Differential Equations by a Probabilistic Domain Decomposition,** *Journal of Scientific Computing*, Vol. 43, Issue 2, 135–157, 2009

24. D. Sánchez, D. Isern, A. Rodríguez, A. Moreno, **General Purpose Agent–Based Parallel Computing**, In: Omatu, S., Rocha, M.P., et.al. (eds.): In Proc. of Distributed Computing, Artificial Intelligence, Bioinformatics, Soft Computing, and Ambient Assisted Living. 10th International Work–Conference on Artificial Neural Networks, IWANN 2009 *Lecture Notes in Computer Science*, Vol. 5518, Springer Berlin/Heidelberg, Salamanca, Spain, 231–238, 2009

Presentations

1. A. Rodríguez-Rozas, **Quantum Computing in Finance**, in Afi Escuela de Finanzas, masterclass (2023)

2. A. Rodríguez-Rozas, **Quantum Computing Research in Finance**, at Banco Santander Chile's Innovation Week (2023)

3. A. Rodríguez-Rozas, **Quantum Computing Research in Finance**, at Banco Santander, Young Leaders programm (2023)

4. A. Rodríguez-Rozas, **Quantum Computing Research in Finance**, at Universidad Carlos III, invited seminar (2023)

5. A. Rodríguez-Rozas, **Quantum Computing in Finance**, at Afi Escuela de Finanzas, masterclass (2022)

6. A. Rodríguez-Rozas, **A PDE-based Quantum Algorithm for Pricing Financial Derivatives**, in *15th Annual Banking Credit Risk Summit, Vienna, February 2022*. (invited)

7. A. Rodríguez-Rozas, **A PDE-based Quantum Algorithm for Pricing Financial Derivatives**, in *QuantMinds International Conference, Barcelona, November 2021*. (invited)

8. A. Rodríguez-Rozas, **Perspectives and Challenges in Quantum Computing Research for the Pricing of Financial Derivatives**, in *Banco Santander (SCIB Front Office & Market Risk), Madrid, June 2021*. (invited)

9. A. Rodríguez-Rozas, **Perspectives and Challenges in Quantum Computing for the Pricing of Financial Derivatives**, in *ICE-2021 Industrial Day, Madrid, May 2021*. (invited)

10. A. Rodríguez-Rozas, **Pricing Financial Derivatives with Exponential Quantum Speedup**, in *WBS - The Quantitative Finance Conference Spring Edition, London, March 2021*. (invited)

11. A. Rodríguez-Rozas, A Novel Hybrid Monte Carlo-FEM Approach to Solving Credit Risk Valuation Problems**,** *14ᵗʰ Annual Banking Credit Risk Management Summit, Vienna (Austria), February 2021.* (invited)

12. A. Rodríguez-Rozas, **Hybrid Monte Carlo-FEM method: a new way to solve complex pricing problems,** *QuantMinds International 2020, Hamburg, November 2020.* (invited)

13. A. Rodríguez-Rozas, **Prospects and Challenges in Quantum Computing Research for the Pricing of Financial Derivatives**, in *WBS Quantum Computing in Finance Conference, London, November 2019*. (invited)

14. A. Rodríguez-Rozas, The PDD method for solving linear, non-linear, and fractional PDEs problems, in *Nonlocal and Fractional Operators (NLFO) - In honour to Prof. Renato Spigler*, Rome, Italy, Apr 2019. (invited)

15. A. Rodríguez-Rozas, **Mathematiclal modelling and computational aspects in Fiance**, BCAM seminar, Bilbao, Jan 2019. (invited)

16. M. Shahriari, S. Rojas, D. Pardo, A. Rodríguez-Rozas, S. A. Bakr, V. M. Calo, I. Muga, **A fast multi-scale finite element method for geophysical resistivity measurements**, 20th International Conference on Structural and Computational Geophysics (ICSCG 2018), Prague, Czechia, September 2018.

17. M. Shahriari, S. Rojas, D. Pardo, A. Rodriguez-Rozas, S. A. Bakr, V. M. Calo, I. Muga, **A Fast 1.5D Multi-scale Method for Geophysical Measurements**, P.hD Light Seminar, BCAM, Bilbao, Spain, April 2018.

18. A. Rodríguez-Rozas, D. Pardo, and C. Torres-Verdín, **Fast Simulation and Inversion of Borehole Resistivity Measurements**, invited seminar at MIT Earth Resources Laboratory, MIT, Cambridge, MA, USA, Decemeber 2017. (invited)

19. D. Pardo, A. Rodríguez-Rozas, J. Álvarez-Aramberri, Some Modeling and Simulation Challenges in Petroleum Engineering, Univ. Carlos III, Madrid, Spain, 2017 (invited)

20. A. Rodríguez-Rozas, D. Pardo, and C. Torres-Verdín, **Fast simulations of 2.5D LWD resistivity tools**, "79th EAGE Conference and Exhibition", Paris, France, Jun 2017.

21. D. Pardo, C. Torres-Verdín, and A. Rodríguez-Rozas, **1.5D based inversion of logging-while-drilling resistivity measurements in 3D formations**, "79th EAGE Conference and Exhibition", Paris, France, Jun 2017.

22. A. Rodríguez-Rozas, D. Pardo, and C. Torres-Verdín, **Fast and parallel 2.5D finite element forward simulations of borehole resistivity measurements**, "Workshop on Geophysical Applications and HPC", Barcelona, Spain, Jun 2017.

23. D. Pardo, C. Torres-Verdín, and A. Rodríguez-Rozas, **1.5D based inversion of logging-while-drilling and extra-deep azimuthal resistivity measurements in 3D formations**, "Workshop on Geophysical Applications and HPC", Barcelona, Spain, Jun 2017.

24. A. Rodríguez-Rozas, D. Pardo, and C. Torres-Verdín, **Fast 3D Inversion of Borehole Resistivity Measurements using a Dimension-Adaptive Simulation Method,** "The 6th International Symposium in Three-Dimensional Electromagnetics", Berkely, California, USA, Mar. 2017.

25. D. Pardo, A. Rodríguez-Rozas, C. Torres-Verdín, **Fast dimensionally adaptive inversion of LWD and deep azimuthal resistivity measurements. Part I: Latest Advances**, "Joint Industry Research Consortium on Formation Evaluation" (Seventeenth Annual Meeting), Austin, TX, USA, Aug 2017.

26. A. Rodríguez-Rozas, D. Pardo, C. Torres-Verdín, **Fast dimensionally adaptive inversion of LWD and deep azimuthal resistivity measurements. Part II: Practical Examples**, "Joint Industry Research Consortium on Formation Evaluation" (Seventeenth Annual Meeting), Austin, TX, USA, Aug 2017.

27. D. Pardo, A. Rodríguez-Rozas, J. Alvarez-Aramberri, **Some Modeling and Simulation Challenges in Petroleum Engineering**, Univ. Carlos III of Madrid, Spain, Mar 2017. (invited)

28. A. Rodríguez-Rozas, D. Pardo, C. Torres-Verdín, **Advances Toward the Fast Simulation of 2.5D LWD and Deep Azimuthal Resistivity Tools**, 16th Joint Industry Research Consortium on Formation Evaluation, The University of Austin at Texas, Austin, TX, USA, Aug 2016. (invited)

29. M. Shariari, S. Rojas, D. Pardo, Á. Rodríguez-Rozas, S. A. Bakr, V.M. Calo, I. Muga, **A Fast 1.5D Numerical Solver for Electromagnetics, AGH University of Science and Technology**, Poland, 2017

30. Ángel Rodríguez-Rozas, David Pardo, **A Priori Fourier Analysis for 2.5D Finite Elements Simulations of Logging-While-Drilling (LWD) Resistivity Measurements**, ICCS2016, San Diego, California, USA, 3-6 Jun 2016. (invited)

31. Julen Alvarez-Aramberri, David Pardo and Ángel Rodríguez-Rozas, **Dimensional Adaptivity in Magnetotellurics**, ICCS2016, San Diego, California, USA, 3-6 June 2016.

32. V. Darrigrand, D. Pardo, I. Muga, A. Rodríguez-Rozas, **Goal-Oriented Adaptivity using Unconventional Error Representations**, submitted to *12th World Congress on Computational Mechanics (WCCM 2016)*, Seoul, Korea, 24-29 July 2016. (invited)

33. V. Darrigrand, D. Pardo, I. Muga, A. Rodríguez-Rozas, **Generalised Error Representations for Goal-Oriented Adaptivity**, Seminar, University of Valparaíso, Chile, Jan 2016. (invited)

34. D. Pardo, S. Bakr, A. Rodríguez-Rozas, C. Torres-Verdín, **Dimensionally Adaptive Methods for the Simulation and Inversion of Electromagnetic Geophysical Measurements**, Seminar, Barcelona Supercomputing Center (BSC), Spain, Sep 2015. (invited)

35. A. Rodríguez–Rozas, D. Pardo, C. Torres-Verdín (2015), **Development of a general framework for the rapid simulation of 2D and 2.5D borehole resistivity measurements**, Joint Industry Research Consortium on Formation Evaluation (Fifteenth Annual Meeting), Austin, TX, USA, Aug 2015. (invited)

36. A. Rodríguez–Rozas, J. Diaz, **High-order Implicit and Explicit Non-Conforming Finite Element Methods for Elastoacoustic Problems**, *2nd Frontiers in Computational Physics Conference*, Zurich, Switzerland, Jun 2015.

37. A. Rodríguez–Rozas, J. Diaz, **An Efficient Geometrically Based Non-Conforming Method for Wave Propagation Problems**, *Workshop on Advanced Subsurface Visualization Methods: "Exploring the Earth"*, GEAGAM network, May 2015. (invited)

38. A. Rodríguez–Rozas, J. Diaz, H. Barucq, **High–Order Non–Conforming Finite Element Methods for Time Domain Acoustic–Elastic Problems**, *The Second Basque–Hungarian Workshop on Numerical Methods for PDEs*, Bilbao, Spain, Jan 2015. (invited)

39. A. Rodríguez–Rozas, J. Diaz, H. Barucq, **High–Order Non–Conforming Finite Element Methods for Time Domain Acoustic–Elastic Problems**, *ICOSAHOM 2014*, Salt Lake City, Utah, USA, Jun 2014.

40. A. Rodríguez–Rozas, J. Diaz, H. Barucq, **High–Order Finite Element Methods for Time Domain Acoustic–Elastic Problems**, invited talk in *Third International Workshop on Multiphysics, Multiscale and Optimization Problems*, Bilbao, Spain, May 2014. (invited)

41. A. Rodríguez–Rozas, **New Perspectives on Computational Mathematics: The Probabilistic Domain Decomposition Method for Solving (Nonlinear) PDEs**, *BCAM Seminar*, BCAM, Bilbao, Spain, Dec 2013. (invited)

42. A. Rodríguez–Rozas, J. Diaz, **Non–Conforming Meshes with Curved Elements and Local–Stepping for the Simulation of Wave Propagation in Elasto–Acoustic Media**, *Second Workshop of the HPC–GA Project*, Bilbao, Mar 2013. (invited)

43. A. M. Gambaruto, A. Rodríguez–Rozas, **Blood Flow in Micro-Sized Physiological Conduits using Moving-Particle Semi-implicit (MPS) Method**, *Particle 2011 – II International Conference on Particle-Based Method, Fundamentals and Applications*, Barcelona, Spain, Oct 2011.

44. J. A. Acebron, A. Rodríguez–Rozas, **An Efficient Parallel Numerical Method for Solving Reaction–Diffusion Partial Differential Equations Based on Generalized Random Trees**, *The International Conference on Applied Mathematics, Modeling and Computational Science (AMMCS–2011)*, Waterloo, Ontario, Canada, Jul 2011.

45. A. M. Gambaruto, A. Rodríguez–Rozas, A. Sequeira, **Parallel Solvers Simulating Flow in Capillaries Using the Moving Particle Semi–Implicit Method**, *Congresso de Métodos Numéricos em Engenharia (CMNE) 2011*, Coimbra, Portugal, Jun 2011.

46. A. Rodríguez–Rozas, **A New Parallel Solver Suited for Arbitrary Semilinear Parabolic Partial Differential Equations Based on Generalized Random Trees**, *Seminars in Analysis, Geometry and Mathematical Physics*, Universidade do Minho, Braga, Portugal,

Jan 2011. (invited)

47. A. Rodríguez–Rozas, **Monte Carlo and Quasi–Monte Carlo Methods in Scientific Computing**, *Seminar*, Department of Mathematics, Instituto Superior Tecnico, Lisbon, Portugal, Oct 2010. (invited)

48. A. Rodríguez–Rozas, **Recent Advances in Isogeometric Analysis**, *Colloquium*, Department of Mathematics, Instituto Superior Tecnico, Lisbon, Portugal, Nov 2010. (invited)

49. J. A. Acebrón, A. Rodríguez–Rozas, **Stochastic Methods on Supercomputers, Workshop in Stochastic Methods for Turbulence Simulations**, *Commissariat a l´Energie Atomique (CEA)*, Cadarache, France, Nov 2010. (invited)

50. J. A. Acebrón, A. Rodríguez–Rozas**, Numerical Solution of Nonlinear Two–Dimensional Parabolic Partial Differential Equations by Branching Stochastic Processes**, *2010 SIAM Annual Meeting (AN'10)*, Pittsburgh, Philadelphia, USA, Jul 2010.

51. J. A. Acebrón, A. Rodríguez–Rozas, **New Probabilistc Approaches to Solve Nonlinear Parabolic Partial Differential Equations by Branching Stochastic Processes**, *International Congress on Computational and Applied Mathematics (ICCAM'10)*, Leuven, Belgium, Jul 2010.

52. J. A. Acebrón, A. Rodríguez–Rozas**, Efficient Numerical Methods for Plasma Physics: Towards Realistic Simulations in Fusion Energy**, *Seminar*, Department of Mathematics, Instituto Superior Técnico, Lisbon, Portugal, Nov 2009. (invited)

53. J. A. Acebrón, A. Rodríguez–Rozas, R. Spigler, and R. Vilela–Mendes, **A Probabilistic–Based Numerical Method for Solving Efficiently the Three–Dimensional Fourier Transformed Vlasov–Poisson Equation**, *21st International Conference on Numerical Simulation of Plasmas 2009*, Lisbon, Portuga, Oct 2009.

54. J. A. Acebrón, A. Rodríguez–Rozas, and R. Spigler, **Probabilistic Domain Decomposition of Nonlinear Parabolic Partial Differential Equations by Random Trees**, *19th International Conference on Domain Decomposition Methods*, Zhangjiajie, China, Aug 2009.

55. J. A. Acebrón, A. Rodríguez–Rozas, and R. Spigler, **New Challenges in Parallel Scientific Computing: The Successful Case of a Probabilistic Domain Decomposition Method**, *Workshop on kinetics and statistical methods for complex particle systems*, Lisbon, Portugal, Jul 2009. (invited)

56. J. A. Acebrón, A. Rodríguez–Rozas, R. Spigler, **Numerical Solution of Nonlinear Parabolic Partial Differential Equations by Branching Stochastic Processes**, *SIAM Conference on Computational Science and Engineering*, Miami, USA, Mar 2009
D. Sánchez, A. Rodríguez, A. Moreno (2007), **Parallel Execution of Complex Tasks Using a Distributed, Robust and Flexible Agent Platform**, *DESMA'07*, Zaragoza, Spain, Sep 2007.

Participation in research projects

I. Participation as PI/Co-PI

- **UpVel**, PI at BCAM, research project with Repsol under the call *Repsol Inspire Programme 2016*, 2017-2018
- **Geophysical Exploration using Advanced Galerkin Methods (GEAGAM)**, PI at BCAM, European H2020 RISE Project, 2015-2017
- **MATHROCKS**, PI at BCAM, European H2020 RISE Project, 2018-2023.

II. Participation in other projects

- **High Performance Computing for Geophysics Applications**, Entities involved: INRIA (France), UFRGS (Brasil), BCAM (Spain), and UNAM (Mexico), Financial entity: FP7 IRSES, PI: Jean–François Méhaut, Jan. 2012–Nov. 2014.
- **Scalable and Fault Tolerant Algorithms based on probabilistic methods**, Financial entity: Bilateral project Portugal–Spain funded by FCT, and CSIC (Spain), PI: Juan A. Acebrón, 2011—2012.
- **New parallel numerical algorithms for current and future high performance supercomputers**, Financial entity: the Portuguese Science Foundation (FCT), contract PTDC/EIA–CCO/098910/2008, PI: Dr. Juan A. Acebrón, 2010—2012.
- **Stochastic Analysis and Numerical Approximations in Mathematical Finance**, Financial entity: the Portuguese Science Foundation (FCT), contract UTA_CMU/MAT/0006/2009, PI: Dr. Maria da Conçeicao Carvalho, 2009—2011.
- **Cardiovascular Imaging Modeling and Simulation – SIMCARD**, Collaborative project between The University of Texas at Austin and the Instituto Superior Técnico, Financial entity: the Portuguese Science Foundation (FCT), contract UTAustin/CA/0047/2008, PI: Dr. Adélia Sequeira, May 2009—May 2012.
- **Probabilistic domain decomposition for nonlinear partial differential equations**, Financial entity: the Rome Supercomputing Center (CASPUR, Rome, Italy), granted access supercomputing facilities, PI: Juan A. Acebrón, 2009—2011.
- **New computational methods for current and future high performance supercomputers**, Financial entity: Scientific and Technological cooperation between FCT and CNR (Italy), PI: Juan A. Acebron, 2009.

- **Developing highly efficient scientific computing algorithms suited for new generation of high performance computers**, Financial entity: Integrated Action Spain–Italy, Ministerio de Educación y Ciencia,Spain, and Ministero dell'Universita e della Ricerca, Italy, PI: Dr. Juan A. Acebrón, 2007—2008.
- **Probabilistic Domain Decomposition for partial differntial equations**, Financial entity: Barcelona Supercomputing Center, MareNostrum Granted Access, PI: Dr. Juan A. Acebrón, Oct. 2006—Oct. 2008.