

João Guilherme CALDAS STEINSTRÆSSER

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Postdoctoral research fellow in Applied Mathematics at the Institute of Mathematics and Statistics of the University of São Paulo (IME-USP), Brazil

Formation

Degrees

- **2018 - 2021: PhD in Applied Mathematics**, Inria Sophia-Antipolis (Montpellier antenne - LEMON team) and University of Montpellier (IMAG-UM).
 - Title of the thesis: *Coupling large and small scale shallow water models with porosity in the presence of anisotropy*;
 - Supervisors: Antoine ROUSSEAU (LEMON team and IMAG-UM) and Vincent GUINOT (HSM-UM and LEMON team);
 - Defended on October 1st, 2021.
- **2016-2017: Master M2 ANEDP (Numerical Analysis and Partial Differential Equations)**, University Pierre et Marie Curie (Paris VI), École Polytechnique and École des Ponts ParisTech (France).
 - Eiffel Excellence Scholarship (Campus France);
 - Average results: 14.34/20.
- **2014-2017: Bachelor's degree in Mathematics and Informatics Engineering**, École des Ponts ParisTech (France), in the context of a double degree program with the University of São Paulo.
 - Eiffel Excellence Scholarship (Campus France);
 - Average results: 14.01/20.
- **2011-2018: Bachelor's degree in Civil Engineering**, Polytechnic School of the University of São Paulo (Brazil).
 - Classification in entrance exam: 4th out of 10866;
 - Average results: 8.7/10;
 - Position in entrance group: 2nd out of 158.

Additional courses

- **January 2020: Introduction to pedagogic tools for teaching in university**. University of Montpellier (France);
- **November 2019: Parallel programming models MPI, OpenMP**. CERFACS. Toulouse (France);
- **April 2019: Introduction to the teaching of Mathematics in the beginning of university**. University of Montpellier (France);
- **November 2018: Training on Domain Decomposition Methods (*Cinquièmes rencontres numériques lilloises*)**. University of Lille - Mathematics department of the Sciences and Technologies school. Villeneuve d'Ascq (France);
- **November 2018: Training on advanced C++**. Inria Sophia-Antipolis (France);
- **June 26th-30th 2017: summer school on numerical modeling of waves and utilization of the model WaveWatch III**, European University Institute for the Sea (IUEM). Brest (France);
- **May 2017: CROCO users meeting**, Observatory Midi-Pyrénées. Toulouse (France).

Publications

In journals

- [1] J. G. C. Steinstraesser, V. Guinot, and A. Rousseau, “Modified parareal method for solving the two-dimensional nonlinear shallow water equations using finite volumes,” en, *The SMAI journal of computational mathematics*, vol. 7, pp. 159–184, 2021. DOI: 10.5802/smai-jcm.75. [Online]. Available: <https://smai-jcm.centre-mersenne.org/articles/10.5802/smai-jcm.75/>.
- [2] J. G. Caldas Steinstraesser, G. Kemlin, and A. Rousseau, “A domain decomposition method for linearized boussinesq-type equations,” *Journal of Mathematical Study*, vol. 52, no. 3, pp. 320–340, 2019. [Online]. Available: http://global-sci.org/intro/article_detail/jms/13301.html.
- [3] J. G. Caldas Steinstraesser, R. Cienfuegos, J. D. Galaz Mora, and A. Rousseau, “A Schwarz-based domain decomposition method for the dispersion equation,” *Journal of Applied Analysis and Computation*, vol. 8, no. 3, pp. 859–872, Jun. 2018. [Online]. Available: <http://www.jaac-online.com/article/doi/10.11948/2018.859>.

In conferences proceedings

- [4] J. G. Caldas Steinstraesser, V. Guinot, and A. Rousseau, “Application of a modified parareal method for speeding up the numerical resolution of the 2D shallow water equations,” in *Simhydro 2021 - 6th International Conference Models for complex and global water issues - Practices and expectations*, Sophia Antipolis, France, Jun. 2021. [Online]. Available: <https://hal.inria.fr/hal-03224056>.
- [5] J. G. Caldas Steinstraesser, C. Delenne, P. Finaud-Guyot, V. Guinot, J. L. Kahn Casapia, and A. Rousseau, “SW2D-LEMON: a new software for upscaled shallow water modeling,” in *Simhydro 2021 - 6th International Conference Models for complex and global water issues - Practices and expectations*, Sophia Antipolis, France, Jun. 2021. [Online]. Available: <https://hal.inria.fr/hal-03224050>.
- [6] E. Audusse, J. C. Steinstraesser, L. Emerald, P. Heinrich, A. Paris, and M. Parisot, “Comparison of models for the simulation of landslide generated tsunamis,” A. Duran, B. Fabréges, P. Lafitte, F. Lagoutière, F. Marche, and F. Rousset, Eds., vol. 70, EDP Sciences, 2021, pp. 14–30. DOI: 10.1051/proc/202107002. [Online]. Available: <https://doi.org/10.1051/proc/202107002>.
- [7] J. G. Caldas Steinstraesser, G. Kemlin, and A. Rousseau, “Domain decomposition methods for linearized Boussinesq-type equations,” in *16èmes Journées de l’Hydrodynamique*, École Centrale de Marseille and Irphé (Institut de Recherche sur les Phénomènes Hors Équilibre), Marseille, France, Nov. 2018. [Online]. Available: http://website.ec-nantes.fr/actesjh/images/16JH/Articles/JH2018_papier_01D_Caldas-Steinstraesser_et_al.pdf.

Participations in Conferences and Symposiums

- **December 2020:** CAN-J 2020 (National Congress of Numerical Analysis for Young Researchers). *A modified ROM-based parareal method for solving the two-dimensional nonlinear shallow water equations* (J. G. Caldas Steinstraesser, V. Guinot and A. Rousseau). Online.
- **November 2018:** 3rd International Workshop on Wave & Tidal Energy. *Discrete transparent boundary conditions for domain decomposition in coastal oceanography* (J. G. Caldas Steinstraesser, G. Kemlin and A. Rousseau). MERIC (Marine Energy Research & Innovation Center) et Universidad Austral de Chile. Valdivia (Chile).
- **December 2017:** Interdisciplinary Symposium on Computational Methods for Flow Phenomena. *Operational coupling in coastal oceanography: study on transparent boundary conditions for a Boussinesq-type model*. Pontificia Universidad Catolica de Chile. Santiago (Chile).

Participations in Seminars

- **January 2021:** *A modified ROM-based parareal method for the simulation of urban floods*. Inria AIRSEA team.
- **January 2021:** *A modified ROM-based parareal method for the simulation of urban floods*. Laboratoire J.A. Dieudonné (JAD), University Côte d’Azur.
- **November 2020:** *Multiscale coupling of porosity-based shallow water models for the simulation of urban floods*. HydroSciences Montpellier (HSM), University of Montpellier.

- **November 2020:** *A modified parareal method for solving the two-dimensional nonlinear shallow water equations.* Institut Montpelliérain Alexander Grothendieck (IMAG), University of Montpellier.

Professional experience

Scientific projects

- **December 2021 - November 2023: Postdoctoral project** at the Department of Applied Mathematics of the Institute of Mathematics and Statistics of the University of São Paulo (IME-USP). São Paulo (Brazil)
 - Project title: *Parallel-in-time resolution of the shallow water equations on the rotating sphere using spherical harmonics and semi-Lagrangian discretization;*
 - Supervisor: Prof. Dr. Pedro da SILVA PEIXOTO;
 - Scholarship of FAPESP (São Paulo Research Foundation);
 - Brief description: study and implementation of parallel-in-time methods for solving the shallow water equations on the sphere, in the context of atmospheric circulation models for numerical weather prediction and climate simulation.
- **Juillet - Août 2019: Participation to CEMRACS 2019.** Marseille (France)
 - Project title: *Comparison of models for the simulation of landslide generated tsunamis;*
 - Brief description: comparison of the numerical simulation of landslide generated tsunamis using the Navier-Stokes, the Boussinesq and the shallow water equations.
- **March - August 2018: Introduction to Scientific Research project** in the Laboratory of Computational Mechanics (LMC) in the Polytechnic School of the University of São Paulo. São Paulo (Brazil).
 - Title of the project: *Development of a software for the parameterization of wheel and railroad tracks profiles;*
 - Supervisor: Prof. Dr. Alfredo GAY NETO (Polytechnic School of the University of São Paulo-Department of Engineering of Structures and Geotechnics);
 - Brief description: Mathematical formulation and implementation of optimization problems (fitting of arcs/splines/NURBS to a cloud of points) for parametrizing wheel and railroad track profiles, aiming the application in computational mechanics models for studying the contact between these elements;
 - Scholarship of FDTE (Foundation for the Technological Development of the Engineering - São Paulo).
- **May 2017 - January 2018: Internship** at Inria Sophia-Antipolis (LEMON team), France Énergies Marines and MERIC (Marine Energy Research & Innovation Center). Montpellier and Brest (France), Santiago (Chile).
 - Title of the project: *Operational Coupling in coastal oceanography;*
 - Supervisor: Antoine ROUSSEAU;
 - Brief description: Development of a numerical model coupling a spectral model and a nonlinear dispersive model for wave propagation. Study and proposition of approximate transparent boundary conditions for the latter model.
- **March - August 2016: Internship** at MERIC and Inria Chile. Santiago (Chile).
 - Title of the project: *A domain decomposition method for the resolution of nonlinear dispersive models for wave propagation;*
 - Supervisor: Antoine ROUSSEAU;
 - Brief description: Study and implementation of transparent boundary conditions and Schwarz methods for solving nonlinear dispersive models (KdV and Serre equations).
- **July - December 2015: Internship** at Inria Bordeaux Sud-Ouest in CARDAMOM team. Talence (France)
 - Title of the project: *Mesh adaptation model to surfaces and physical variables applied to fluid mechanics problems;*
 - Supervisors: Cécile DOBRZYNSKI and Mario RICCHIUTO.

- Brief description: Study of mesh adaptation models; development of a library in C for applying these methods in computational fluid mechanics codes.
- **August 2012 - July 2014: Introduction to Scientific Research project.** São Paulo (Brazil).
 - Titles of the projects: *Numerical methods in partial differential equations and application* (1st year); *Numerical methods in partial differential equations with applications in numerical weather forecast* (2nd year).
 - Supervisor: Prof. Dr. Saulo RABELLO MACIEL DE BARROS (Institute of Mathematics and Statistics of the University of São Paulo- Department of Applied Mathematics);
 - Brief description: introduction, study and implementation of various numerical methods for partial differential equations; numerical resolution of the shallow-water equations for atmospheric circulation using Fortran and MPI.
 - Scholarship of the University of São Paulo.

Teaching

- **2020-2021: University of Montpellier (Department of Mechanics of the Faculty of Sciences (Méca-FDS) and Polytech Montpellier (engineering school))**
 - Modelling and conception of mechanical systems (Méca-FDS level L1, exercises classes (TD), 24h);
 - Dynamics of mechanical systems (Level L2, exercises classes (TD), 22,5h);
 - Mathematical modelling in Mechanics (Méca-FDS level L3 and Polytech - first year, practical works (TP), 18h);
- **2019-2020: University of Montpellier (Department of Mechanics of the Faculty of Sciences (Méca-FDS) and Polytech Montpellier (engineering school))**
 - Modelling and conception of mechanical systems (Méca-FDS level L1, exercises classes (TD), 9h);
 - Dynamics of mechanical systems (Level L2, exercises classes (TD), 18,5h);
 - Mathematical modelling in Mechanics (Méca-FDS level L3 and Polytech - first year, practical works (TP), 18h);
- **March - July 2018: Teacher of differential and integral calculus** at *Estudar com voce* for undergraduate engineering students. São Paulo (Brazil).
 - Brief description: Preparation of video lessons and resolution of exercises.
- **May - June 2013: Teacher at *Federal Concursos* in Linear Algebra and Introduction to Materials Sciences** for applicants to the engineer program at the Polytechnic School of the University of São Paulo. São Paulo (Brazil).
 - Brief description: preparation of video lessons, presential lectures and resolution of exercises.
- **March - July 2012: Assistant teacher in Linear Algebra** at the Polytechnic School of the University of São Paulo.
 - Brief description: assistance to undergraduate students.
- **2008 - 2018: private lessons of Mathematics and Physics** for high school students.

Programming languages

- C/C++
- Fortran
- MPI 2.0 for C/C++ and Fortran
- OpenMP for C/C++ and Fortran
- Python
- MatLab/SciLab
- L^AT_EX

Languages

- Portuguese: mother tongue;
- French: advanced level;
- English: advanced level; TOEIC (February 2015): 900/1000;
- Spanish: advanced level.