Contents

1 Identification and Education

Birthdate and birthplace
Lisbon, May 17, 1960.

Professional address:
Departamento de Matemática
Instituto Superior Técnico
Av. Rovisco Pais, 1049-001 Lisboa
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Affiliation and Position:
Associate Professor at the Department of Matematics, Instituto Superior Técnico, University of Lisbon; Researcher at the Center of Computational and Stochastic Mathematics (CEMAT).

Academic Degrees:

- Master of Sciences in Physics and Mathematics, Lomonossov Moscow State University, 1984; (equivalence to the *Licenciatura em Matemática*, University of Lisbon, final grade - 18).
- Doctor of Philosophy in Physics and Mathematics, Lomonossov Moscow State University, 1990; (equivalence to *Doutoramento em matemática*, Universidade Técnica de Lisboa)
- *Agregação* in Mathematics (Habilitation), Instituto Superior Técnico, 2006.

Specialization:
Computational Mathematics.

Title of the PhD dissertation:
Some problems of the computation of the atom correlation energy.

Documents provided for Agregação :

Report on the course *Numerical Methods for Ordinary Differential Equations*

Lecture on *Accelerating the Convergence of Computational Methods for Differential and Integral Equations*

Research Fields:

- Numerical Methods for Ordinary Differential Equations
- Numerical Methods for Integral and Fractional Order Equations
- Numerical Methods for Functional Equations with Deviating Arguments
- Numerical Methods for Neural Field Equations

Knowledge of Languages:

Portuguese (native) , English, Russian, French.

Diplom of Translator of Scientific Literature (Russian-Portuguese and Portuguese-Russian), 1984.

2 Teaching

2.1 Textbooks

1. I. Katkovskaya, I. Kovaleva, V. Krotov, P. Lima, V. Volkov, O. Zubko, Numerical Analysis and Optimization (in press). Russian versian: Chisleny Analiz i Optimizatsia, Belgosles, Minsk, 2017. (This textbook was composed in the frame of the international project Applied Computation in Engineering and Science, see details of this project in section 3.2.2).

2. Mário Graça and Pedro Lima, Apontamentos de Matemática Computacional, texbook for the course on Computational Mathematics, IST, available at https://www.math.tecnico.ulisboa.pt/∼plima/MCtextbook.pdf

3. Mário Graça and Pedro Lima, Matemática Experimental, ISTPress, 2007.

2.2 Online Lectures

Participation in the Project IEEE-IST Academic, a project of the Student Branch do IEEE at Instituto Superior Técnico, based at Tagus Park campus (http://academic.iee-ist.org/about). Pedro Lima's contribution for this project consisted of 4 modules for the course on Computational Mathematics. Some of these modules are available in Youtube.

2.3 Teaching Activity

2.3.1 Positions

- Teaching assistant at IST, since March 89 to October 1990.
- Assistant Professor at IST, since October 1990 to June 2013 (with a permanent position, since 1995).
- Associate Professor at IST, since June 2013.

From 1990, Pedro Lima was responsible for many courses of different levels. A list of the main ones follows.

2.3.2 Courses for Undergraduate Programmes (Licenciatura)

- *Introdução à Análise Numérica, Matemática Computacional.* These are elementary courses on Numerical Mathematics, included in most of the BSc Programmes in Engineering, Technological Physics and Applied Mathematics.
- *Matemática Experimental.* This course is offered to the 1st year of the undergraduate program in Applied Mathematics and Computation, with the purpose of training students in the solution of problems of different fields of Mathematics using numerical and graphical computation.

2.3.3 Courses of the Master's and PhD Programmes

The following courses were created and offered by the candidate:

- *Numerical methods in quantum mechanics* - analysis of numerical methods for the Schrödinger equation, with applications to the computation of spectra of polielectronic atom (1991-1995).

- *Numerical methods for ordinary differential equations* - analysis of numerical algorithms for initial value and boundary value problems, including advanced topics like numerical solution of singular boundary value problems and extrapolation methods (2005-2022).

- *Mathematical Models in Neuroscience* - analysis of the most well-known mathematical models describing the brain and nervous system (this course is offered as one of the modules of the course Mathematical Modeling and Applications) (2019-2022).

2.4 Supervision of Graduated Students

- Current PhD students:

  - Constantino Caetano, Instituto Superior TÃ©cnico, Thesis subject: fractional differential equations in Mathematical Epidemiology (Supervised by L. Morgado, Niel Hens and P.Lima)
  - Marcos Latas , Faculdade de Medicina da Universidade de Lisboa, Thesis subject: Application of geometric models to the study of intracranian vasculature (supervised by Catarina Fonseca, Hugo Ferreira and P. Lima).

- Supervision of PhD Thesis in Mathematics (former students):

  - António Fernandes Oliveira. Title of thesis: *Numerical and Asymptotic Approximation of Boundary Value Problems for Emden-Fowler equations*; Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa (thesis defended in July 2003).
  - Maria Luisa Ribeiro Morgado. Title of thesis: em Analysis and Numerical Approximation of Singular Boundary Value Problems, Dep. Matemática, Universidade de Trás-os-Montes e Alto Douro (thesis defended in March 2008).
  - Maria Filomena Alves Teodoro. Title of thesis: em Computational Methods for Functional Differential Equations with Deviating Arguments, Instituto Superior Técnico (thesis defended in July 2012).

- Co-supervision of PhD Thesis in Mathematics:

  - Mário Meireles Graça.Title of thesis: *The IRA procedures and other methods in convergence acceleration*, Instituto Superior Técnico (thesis defended in 1997).
  - Magda Stela Rebelo, Title of thesis: *Analytical and numerical methods for nonlinear Volterra integral equations with weakly singular kernel*, Instituto Superior Técnico (thesis defended in July 2010).

- Supervision of Master Thesis in Mathematics:
  - Ana Cristina Soares de Lemos. Title of thesis: *Numerical Solution of the Emden-Fowler Equation by tthe Finite Element Method*, Instituto Superior Técnico (thesis defended in 1995).
  - Matilde Pós-de-Mina Pato. Title of thesis: *Numerical Analysis of Singular Boundary Value Problems*, Mestrado em Matemática e Aplicações, Instituto Superior Técnico (thesis defended in May 2003).
  - Paula Canais Guerreiro. Title of thesis: *Numerical Solution of the Two-Dimensional Neural Field Equation*, Mestrado em Matemática e Aplicações, Instituto Superior Técnico, (thesis defended in December 2018).
  - Madalena França Martins, Title of thesis:*Numerical Solution of the One-dimensional Stochastic Neural Field Equation with Delay*, Mestrado em Matemática e Aplicações, Instituto Superior Técnico, (thesis defended in December 2019).
  - Tiago Filipe Sequeira, Title of thesis: *Numerical Simulation of One and Two-dimensional Stochastic Neural Field Equations with Delay*, Mestrado em Matemática e Aplicações, Instituto Superior Técnico, (thesis defended in July 2021.)
  - Alexandre Cabral, Title of thesis: *Análise comparativa de métodos numéricos para a equação do campo neuronal*, Mestrado em Matemática e Aplicações, IST, (thesis defended in July 2022.)

- Co-supervision of Master Thesis in Mathematics:

  - Maria Isabel da Conceição Santos, Title of thesis: *Numerical Methods for Volterra integral equations with Weakly Singular Kernels*, Instituto Superior Técnico (thesis defended in 1996).
  - Mariana Mendes, Title of thesis: *Numerical solution of equations with non-integer order derivative*, Instituto Superior Técnico,(thesis defended in June 2019).

- Supervison of Post-doc studies:
  - Maria Luisa Morgado, fellowship sponsored by the FCT, on the subject of numerical methods for fractional differential equations, 2009-2010.

2.5 Non-academic Professional Experience

Work as translator for Mir Publishers in Moscow, 1986-1989, and for McGraw-Hill, in Lisbon, 1994. The list of books in Mathematics and Physics translated from Russian to Portuguese follows.

- "Princípios de Mecânica Quântica", V. Fock, Mir, Moscow,1986.
- " A Demonstração em Geometria", A.Fetissov, Mir, Moscow,1985.
- " Fracções Contínuas", N. Beskin, Mir, Moscow,1987.
- " Fórmulas Matemáticas", A.Tsypkin and G.Tsypkin, Mir, Moscow, 1990.
- "Problemas de Equações Diferenciais Ordinárias", M.L.Krasnov, A.I.Kisseliov, G.I.Makarenko, Mc Graw Hill, Lisboa, 1994.

3 Research

3.1 Summary of Research Activity

P. Lima is member of the Center for Computational and Stochastic Mathematics, CEMAT, from its foundation in 1995. (http://www.cemat.tecnico.ulisboa.pt)

The main directions in which he developed his research are enumerated below.

3.1.1 Numerical Methods in Quantum Mechanics

In the first period of his research activity, namely during the preparation of his PhD thesis and in the subsequent two years, P. Lima has worked in this field. His main goal was the creation and implementation of numerical algorithms for the computation of the angular part of matrix elements arising during the numerical solution of the Schrödinger equation for polielectronic atoms. This was the main subject of his PhD dissertation and gave rise to the publications [1] and [2] of section 3.2.1.

3.1.2 Numerical and Asymptotic Analysis of Ordinary Differential Equations (ODE)

The work in this field has started in 1992 and continues up to nowadays. The main directions are:

- Asymptotic analysis of singular boundary value problems (BVP) for ODE;
- Creation and adaptation of numerical algorithms for the approximation of singular BVP;
- Derivation of asymptotic error expansions for numerical methods, applied to singular BVP.
- Convergence acceleration for computational methods through extrapolation methods.

The following items of the list of publications in section 3.2.1 are related with this topic: [3]-[5],[7]-[10],[12],[14]-[16],[18],[20],[23],[26]-[27],[30]-[32],[35],[39],[42],[44],[48],[52],[55
Concerning section 3.2.2, see the following items: [1]-[6],[9]-[11],[14]-[16],[18]-[23],[25],[27],[32],[34].

From the PhD and MSc dissertations mentioned above, the following are in this field:

- António Fernandes Oliveira.
- Maria Luisa Ribeiro Morgado
- Mário Graça
- Matilde Pato

The research project *Computational Method for Singular Problems*, coordinated by P. Lima from 2003 to 2006, is also related to this topic (see more details about this project in sec. 3.3.1)

Some international collaborations were developed in this direction, with the following researchers:

- Dr. Nadezda Konyukhova, from the **Computing Center or of the Russian Academy of Sciences, Moscow**, since 1998 (for joint publications, see sec. 3.2.1 and 3.2.2)
- Prof. Liudmila Uvarova **Department of Mathematics, Moscow State Technological University Stankin (MSTUS)**, since 2001 (she was the initiator of a cooperation agreement between the IST and MSTUS).
- Prof. Ewa Weinmüller and Prof. Othmar Koch, **Vienna University of Technology, Institute for Analysis and Scientific Computing (IASC)**, (for joint publications, see sec. 3.2.1 and 3.2.2)
- Prof. Luisa Morgado, **Universidade de Trás-os-Montes e Alto Douro**,(for joint publications, see sec. 3.2.1 and 3.2.2).

3.1.3 Numerical Analysis of Integral Equations

The work in this field has started in 1992 and continues up to nowadays. The main goals in this field were:

- Asymptotic analysis of Volterra integral equations (VIE) with weakly singular kernels;
- Creation and adaptation of numerical methods for the approximation of VIE;
- Derivation of asymptotic error expansions of computational methods, when applied to VIE with weakly singular kernels;
- Development and application of extrapolation techniques for accelerating the convergence of computational methods, when applied to VIE;
- Analysis and numerical approximation of integral-algebraic equations (systems of integral equations with singular matrices).

The following items of the list of publications in section 3.2.1 are related with this topic: [6],[11],[13],[17],[19],[21]-[22],[24]-[25],[28],[37],[38],[40],[41],[43],[51],[53][54],[56-58], [60], [62-67]. Concerning section 3.2.2, see the following items: [7]-[8],[12]-[13],[17],[29]-[31], [35],[36],[43],[46],[52].

From the PhD and MSc dissertations mentioned above, the following are in this field:

- Magda Rebelo
- Isabel Santos
- Mariana Mendes

The research project *Quality Control of Computational Simulations in Medical Sciences and Environment* (2008-2009), in which P. Lima coordinated the portuguese team, is related to this topic (see more details about this project in sec. 3.3.1) .

Some international collaborations were developed in this direction, with the following researchers:

- Prof. Neville Ford and Dr. Patricia Lumb , **University of Chester, Department of Applied Mathematics**, since 2000. For joint publications, see sec. 3.2.1 and 3.2.2; joint organization International Conferences (IWANASP), see sec.4.1; joint edition of special issues of JCAM and APNUM, see sec. 3.4.2; joint participation in the research project *Quality Control of Computational Simulations in Medical Sciences and Environment*, see sec. 3.3.1.
- Prof. Arvet Pedas dand Prof. Gennadi Vainikko, **Institute of Applied Mathematics, Tartu University, Estonia**, since 2001. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. A. Makroglou, **University of Portsmouth, Department of Applied Mathematics**, since 2006; joint organization of International Conference IWANASP, see sec.4.1, and joint edition of special issue of JCAM, see sec.3.4.2.
- Prof. Tao Tang , **Departament of Mathematics of the Hong Kong Baptist University**; joint edition of special issue of CPAA, see sec. 3.4.2)

- Prof. Mikhail Bulatov, **Institute of Dynamical Systems and Control Theory**, Russian Academy of Sciences, Irkustsk, Russian Federation, since 2010. For joint publications, see sec. 3.2.1 and 3.2.2.
- Dr. Sohrab Bazm, **Marageh University**, Iran, since 2009 . For joint publications, see sec. 3.2.1 and 3.2.2.
- Dr. Somayeh Nemati, **Mazandaran University**, Babolsar, Iran, since 2012. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. Yadollah Ordokhani, **Alzahra University**, Tehran, Iran, since 2012. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. Donatella Occorsio, **University of Basilicata**, Italy, since 2018. For joint publications, see sec. 3.2.1.
- Prof. Luisa Fermo **University of Cagliari** , Italy, since 2018, joint edition of special issue of ANM, see sec.3.4.2 .
- Prof. Azzeddine Belour, **Ecole Normale Superieure de Constantine**, Algeria, since 2017. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. Zdislaw Jackiewicz **Arizona State University**, USA, since 2017, joint edition of special issue of ANM, see sec. 3.4.2 .

3.1.4 Analysis and Numerical Approximation of Boundary Value Problems for Mixed-type Functional Differential Equations (MTFDE)

The work in this field was developed between 2006 and 2014. The main goals in this field were:

- Investigation of existence and uniqueness of solution of BVP for linear MTFDE.
- Creation of computational methods for the given type of problems.
- Creation of computational methods for nonlinear BVP for MTFDE.
- Numerical solution of a stochastic equation arising from MTFDE.

The following papers of section 3.2.1 are related with this topic:[29],[33]-[34],[36], [45],[50]. The following papers of section 3.2.2 are related with this topic: [24],[26],[28],[33],[38], [39], [41].

From the PhD dissertations mentioned above, the thesis of Filomena Teodoro is inline with this research direction.

3.1.5 Neural Field Equations (NFE)

The work in this direction started in 2014, when P. Lima was awarded a Marie Curie fellowship, in the frame of the project 'Neural Field Equations: Stochastic Approach and Numerical Simulations ' (project n. 629496, Call FP7-People-2013-IEF). According to this project, P.M. Lima has worked at the Johannes Kepler University (JKU) , in Linz (Austria), from September 2014 to September 2015, when he started a joint research with Prof. Evelyn Buckwar, director of the Institute of Stochastics at JKU. More details about this project can be found at sec.3.3.2. The work in this field continues up to present and has the following purposes:

- Creation of effective computational algorithms for the approximation of the two-dimensional neural field equation, both in the case of infinite and finite transmission speed (delay equation).
- Analysis of noise-induced changes in the behaviour of neural fields, via a stochastic version of the NFE.
- Simulation of working memory processes through NFE.

The following papers of section 3.2.1 are related with this topic:[47],[59],[61],[68]-[70].

The following papers of section 3.2.2 are related with this topic:[42],[44],[45],[47], [49]-[51], [53], [54].

The research project 'Analysis and numerical simulation of deterministic and stochastic neural field equations with applications to robotics' (NEUROFIELD), 2018-2022, in which P. Lima is the principal investigator, fits this subject (see more details about this project in sec. 3.3.1) .

From the MSc dissertations mentioned above, the following are in this field:

- Paula Guerreiro

- Madalena França
- Tiago Sequeira

Some national and international collaborations were developed in this direction, with the following researchers:

- Prof. Wolfram Erlhagen, University of Minho (Portugal), who was the coordinator of the project NEUROFIELD at his university. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. Evelyn Buckwar, director of the Institute of Stochastics at Johannes Kepler University (Austria), who was the coordinator of the project NEUROSTOCHSIM. For joint publications, see sec. 3.2.1 and 3.2.2.
- Prof. Stephen Coombes, from the University of Nottingham, who hosted P. Lima during his sabatical leave in 2018. For joint publications, see sec. 3.2.1.
- Prof. Daniele Avitabile, Vrije Universiteit, Amsterdam. For joint publications, see sec. 3.2.1.

3.2 Scientific Publications

ORCID NUMBER: 0000-0001-6255-3303
Scopus Author ID: 35556114700
ResearcherID: G-9359-2014

87 publications indexed in Scopus, with a total of 931 citations, h-index 18 (16/03/2022).

3.2.1 Publications in International Journals with Peer Review

1. P.M.Lima, A program for deriving recoupling coefficients formulae, Computer Physics Communications, 66 (1991) 89-98.
2. P.M.Lima, A new program for calculating matrix elements in atomic structure, Computer Physics Communications, 66 (1991) 99-114.

3. P.M.Lima, Richardson extrapolation in boundary value problems for differential equations with non-regular right-hand side, Journal of Computational and Applied Mathematics, 50 (1994) 385-400.

4. P.M.Lima and M.M.Graça, Convergence acceleration for boundary value problems with singularities using the E-Algorithm , Journal of Computational and Applied Mathematics, 61 (1995) 139-164.

5. P.M. Lima, Numerical methods and asymptotic error expansions for the Emden-Fowler equations, Journal of Computational and Applied Mathematics, 70 (1996) 245-266.

6. P.M.Lima and T. Diogo, An extrapolation method for a Volterra integral equation with weakly singular kernel, Applied Numerical Mathematics, 24 (1997) 131-148.

7. P.M. Lima and M.Carpentier, Asymptotic expansions and numerical approximation of non-linear degenerate boundary-value problems, Applied Numerical Mathematics, 30 (1999) 93-111.

8. P.M. Lima and M.Carpentier, Iterative methods for a singular boundary-value problem, Journal of Computational and Applied Mathematics, 111 (1999) 173-186.

9. P.M. Lima and M.Carpentier, Numerical solution of a singular boundary-value problem in non-newtonian fluid mechanics, Computer Physics Communications, 126 (2000) 114-120.

10. P.M. Lima and A.Oliveira, Aproximação de problemas de valores de fronteira singulares usando subsoluções e supersoluções, Tendências da Matemática Aplicada e Computacional,1,n.2 (2000) 401-414.

11. T.Diogo, P.M.Lima and N.B.Franco, Analysis of product integration methods for a class of singular Volterra integral equations, Tendências da Matemática Aplicada e Computacional,1,n.2 (2000) 373-387.

12. A.L Dyshko, M.P. Carpentier, N.B. Konyukhova and P.M. Lima, Singular problems for Emden-Fowler-type second-order nonlinear ordinary differential equations, Comput. Maths Math. Phys., 41 (2001) 557-580.

13. T.Diogo and P.M.Lima, Numerical solution of a non-uniquely solvable Volterra integral equation using extrapolation methods, Journal of Computational and Applied Mathematics, 140 (2002) 537-557.

14. P.M.Lima and A.Oliveira, Numerical methods and error estimates for a singular boundary-value problem, Mathematical Modelling and Analysis, 7 (2002) 271-284.

15. Konyukhova, N.B., P.M.Lima and M.P.Carpentier, Asymptotic and Numerical Approximation of a Nonlinear Singular Boundary Value Problem, Tendências da Matemática Aplicada e Computacional, 3, No. 2 (2002) 141-150.

16. P.M.Lima and A.Oliveira, Numerical solution of a singular boundary value problem for a generalized Emden-Fowler equation, App. Num. Math., 45 (2003) 389-409.

17. T.Diogo, N.Franco, P.M.Lima, High-order product integration methods for a Volterra integral equation with logarithmic singular kernel, Communications on Pure and Applied Analysis, 3 (2004) 217-235.

18. P.M.Lima, N.B.Konyukhova, N.V.Chemetov and A.I.Sukov, Analytical-numerical investigation of bubble-type solutions of nonlinear singular problems, Journal of Computational and Applied Mathematics, 189 (2006) 260-273.

19. T. Diogo, N.J. Ford, P.M.Lima and S. S.Valtchev, Numerical methods for a Volterra integral equations with non-smooth solutions, Journal of Computational and Applied Mathematics, 189 (2006) 412-423.

20. P.M.Lima and L. Morgado, Analysis of singular boundary value problems for an Emden-Fowler equation, Communications on Pure and Applied Analysis, 5 (2006) 321-336 .

21. T. Diogo, P.M. Lima and M.S.Rebelo, Numerical solution of a nonlinear Abel type Volterra integral equation, Communications on Pure and Applied Analysis, 5(2006) 277-288.

22. T. Diogo, N.J. Ford, P.M.Lima and S.M.Thomas, Solution of a singular integral equation by a split-interval method, International Journal on Numerical Analysis and Modeling, 4 (2007) 63-73.

23. G. Kitzhofer, O. Koch, P.M. Lima and E. Weinmüller, Efficient numerical solution of the density profile equation in hydrodynamics, Journal of Scientific Computing, 32 (2007) 411-424.

24. N.J.Ford, T.Diogo, J.Ford and P.Lima, Numerical modelling of qualitative behaviour of solutions to convolution integral equations, J. Comp. Appl. Math., 205 (2007) 849-858.

25. Teresa Diogo and Pedro Lima, Collocation solutions of a weakly singular Volterra integral equation, TEMA - Tendências da Matematica Aplicada e Computacional, Vol. 8 , N.2 (2007) 229-238.

26. P. Lima and L. Morgado, Analysis and numerical approximation of a free boundary problem for a singular ordinary differential equation, TEMA- Tendências da Matemática Aplicada e Computacional, Vol. 8, N.2 (2007) 259-268.

27. N.B. Konyukhova, P.M. Lima, M.L. Morgado and M.B. Soloviev, Bubbles and droplets in nonlinear physics models: analysis and numerical simulation of singular nonlinear boundary value problems, Comp. Maths. Math. Phys. 48, N.11 (2008)2018-2058.

28. T. Diogo and P.Lima, Superconvergence of collocation methods for a class of weakly singular Volterra integral equations, Journal of Computational and Applied Mathematics, 218 (2008) 307–316.

29. M.F.Teodoro, P.M. Lima, N. Ford and P. Lumb, A new approach to the numerical solution of forward-backward equations, Frontiers of Mathematics in China, V.4, N.1 (2009) 155-168.

30. P. Lima and L. Morgado, Analytical-numerical investigation of a singular boundary value problem for a generalized Emden-Fowler equation, Journal of Computational and Applied Mathematics, 229 (2009) 480-487.

31. P. Lima and L. Morgado, Numerical modeling of oxygen diffusion in cells with Michaelis-Menten uptake kinetics, Journal of Mathematical Chemistry, 48 (2010) 145-158.

32. P. Lima and L. Morgado, Numerical solution of a class of singular free boundary problems involving the m-Laplace operator, Journal of Computational and Applied Mathematics, 234 (2010) 2838-2847.

33. P. Lima, F.Teodoro, N. Ford and P. Lumb, Analytical and numerical investigation of mixed-type functional differential edquations, Journal of Computational and Applied Mathematics 234 (2010) 2826-2837.

34. N. Ford , P. Lumb, P. Lima, F.Teodoro, The numerical solution of forward-backward differential equations: Decomposition and related issues, Journal of Computational and Applied Mathematics, 234 (2010) 2745-2756.

35. M. Luisa Morgado and Pedro M. Lima, Finite difference solution of a singular boundary value problem for the p-Laplace operator, Numerical Algorithms, 55 (2010) 337-348.

36. P.M. Lima, F. Teodoro N.J. Ford and P. Lumb, Finite element solution of a linear mixed-type functional differential equation, Numerical Algorithms, 55 (2010) 301-320.

37. E. Babolian, S. Bazm and P. Lima, Numerical solution of nonlinear two-dimensional integral equations using rationalized Haar functions, Communications on Nonlinear Science and Numerical Simulation, 16 (2011) 1164-1175.

38. M.V.Bulatov and P.M. Lima , Two-dimensional integral-algebraic systems: analysis and computational methods, Journal of Computational and Applied Mathematics, 236 (2011) 132-140.

39. M. Luisa Morgado and Pedro M. Lima, Efficient computational methods for singular free boundary problems using smoothing variable substitutions, Journal of Computational and Applied Mathematics, 236 (2012) 2981-2989.(Q1 in ISIWEB of Science, Q2 in SCIMAGO)

40. S. Nemati, P.M. Lima, and Y. Ordokhani, Numerical solution of a class of two-dimensional Volterra integral equations using Legendre polynomials, Journal of Computational and Applied Mathematics, 242 (2013) 53-69. (Q1 in ISIWEB of Science, Q2 in SCIMAGO)

41. M. Luisa Morgado, Neville J. Ford and Pedro M. Lima, Analysis and numerical methods for fractional differential equations with delay, Journal of Computational and Applied Mathematics, 252 (2013) 159-168.(Q1 in ISIWEB of Science, Q2 in SCIMAGO)

42. G. Hastermann , P.M. Lima , M.L. Morgado , E.B. Weinmüller, Density profile equation with p-Laplacian: analysis and numerical simulation, Applied Mathematics and Computation 225 (2013) 550-561. (Q1 in ISIWEB of Science and SCIMAGO)

43. M. V. Bulatov, P.M. Lima, E.B. Weinmüller, Existence and uniqueness of solutions to weakly singular integral-algebraic and integrodifferential equations, Cent. Eur. J. Math. , 12 (2014) 308-321.(Q3 on ISIWEB of Science)

44. G.Yu. Kulikov, P.M.Lima and M.L. Morgado, Analysis and numerical approximation of singular boundary value problems with the p-Laplacian in fluid mechanis, Journal of Computational and Applied Mathematics, 262 (2014) 87-104. (Q1 in ISIWEB of Science, Q2 in SCIMAGO)

45. N.J. Ford, P. M. Lima and P. M. Lumb, Commputational methods for a mathematical model of propagation of nervous signals in myelinated axons, Applied Numerical Mathematics 85(2014),38-53. (Q1 in ISIWEB of Science and SCIMAGO)

46. Mário M. Graca, P.M. Lima, Root finding by high order iterative methods based on quadratures, Applied Mathematics and Computation, 264 (2015), 466 - 482. (Q1 in ISIWEB of Science and SCIMAGO)

47. P.M . Lima , E. Buckwar, Numerical solution of the neural field equation in the two-dimensional case, SIAM Journal of Scientific Computing, 37 (2015) B962- B979. (Q1 in ISIWEB of Science and SCIMAGO)

48. M.B. Bulatov, P.M. Lima, and Than Do Tien, An integral method for the numerical solution of nonlinear singular boundary value problems, Bulletin of the South Ural State University, Ser. Mathematical Modelling, Programming and Computer Software, 8 (2015), 5-13. (Q3 in SCIMAGO)

49. M. M. Graça and P.M. Lima, On High Order Barycentric Root-Finding Methods, Tendências em Matemática Aplicada e Computacional, 17, N. 3 (2016), 321-330.

50. N.J. Ford, P.M. Lima and P.M. Lumb, Numerical investigation of noise induced changes to the solution behaviour of the discrete FitzHugh-Nagumo equation, Applied Mathematics and Computation , 293 (2017) 448-460. (Q1 in ISIWEB of Science and SCIMAGO)

51. M. T. Diogo, P.M. Lima, A. Pedas and G. Vainikko, Smoothing transformation and spline collocation for weakly singular Volterra integro-differential equations, Applied Numerical Mathematics, 114 (2017) 63-76. (Q1 in ISIWEB of Science and SCIMAGO)

52. P.M. Lima, M.L. Morgado, M. Schöbinger and E.B. Weinmüller, A Novel computational approach to singular free boundary problems in ordinary differential equations, Applied Numerical Mathematics, 114 (2017) 97-107. (Q1 in ISIWEB of Science and SCIMAGO)

53. S. Nemati and P.M. Lima, Numerical solution of nonlinear fractional integro-differential equations with weakly singular kernels via a modification of hat functions, Appl. Math. Comput., 327 (2018), 79-92.(Q1 in ISIWEB of Science and SCIMAGO)

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3.3 Coordination and Participation in Research Projects

3.3.1 Coordination of Research Projects

- Coordinator of the project *Computational Methods for Singular Problems*, POCTI/MAT/45700/2002, September 2003-September 2006, funded by FCT (Portugal). Webbage: http://www.math.ist.utl.pt/∼plima/alfa/

- Local coordinatar at the University of Lisbon of the project *Quality Control of Computational Simulations in Medical Sciences and Environment*, April 2008- April 2009, funded by *Acções Luso-Britânicas* and *British Council*. Webpage:
http://www.math.ist.utl.pt/∼plima/jointproject/

- Principal investigator of the project 'Analysis and numerical simulation of deterministic and stochastic neural field equations with applications to robotics' (NEUROFIELD), funded by FCT, 2018-2021, POCI-01-0145-FEDER-031393.
Webpage: https://sites.google.com/prod/view/neurofield2019

3.3.2 Participation in research projects and research fellowships

- Researcher of the project PRAXIS XXI/2/2.1/MAT/380/94, *Mathematical Analysis and Numerical Simulation of Non-Newtonian Fluid Models with Applications to the Technology of Polymer Liquid Crystals*, from 1996 to 1999.

- Researcher of the project NATO PST/CLG.976878 *Mathematical Models of Complex Media*, July 2000-July 2002.

- Researcher of the project PTDC/MAT/101867/2008, *Analytical and Computational Methods for Singular Integral Equations*, from January 2010 to January de 2013.

- visiting fellowship awarded by the University of Chester (UK) and sponsored by Santander Bank, in the frame of 'International Research Excellence Awards', from March 2013 to March 2014.

- Researcher of the European Project 'Neural Field Equations: Stochastic Approach and Numerical Simulations ', Marie Curie actions, project n. 629496, Call FP7-People-2013-IEF (Setember 2014- September 2015). Webpage: http://www.math.ist.utl.pt/∼plima/neuro/

- Member of the portuguese team (IST) of the project APPLIED COMPUTING IN ENGINEERING AND SCIENCE, Tempus Project No. 544609-TEMPUS-1-2013-1-AT-TEMPUS-JPCR, 2014-2016.
  Webpage: https://tiss.tuwien.ac.at/fpl/project/index.xhtml?id=320790

3.4 Recognition by the Scientific Community

3.4.1 Scientific Prizes

In 2011, was awarded *menção honrosa* in the field of Mathematics in the *Concurso de Prémios Científicos UTL/Santander Totta*.

3.4.2 Contribution to National and International Journals

- From December 98 to December 99, director of the Bulletin of the Portuguese Mathematical Society.

- From July 2012 to July 2013, member of the editorial board of Abstract and Applied Analysis
  (http://www.hindawi.com/journals/aaa/).

- From 2015 to 2019, member of the editorial board of Opuscula Mathematica (www.opuscula.agh.edu.pl)

- Since 2014, member of the editorial Board of TEMA- Trends in Computational and Applied Mathematics (www.tema.sbmac.org.br/tema).

- Since 2017, member of the editorial board of Applied Numerical Mathematics (https://ees.elsevier.com/apnum/).

- Guest editor of a special issue of Communications on Pure and Applied Analysis, devoted to the First International Workshop on Analysis and

Numerical Approximation of Singular Problems (Communications on Pure and Applied Analysis, Vol. 5, N.2, June 2006).

- Guest editor of a special issue of Journal of Computational and Applied Mathematics, devoted to the Second International Workshop on Analysis and Numerical Approximation of Singular Problems (JCAM, Vol. 229, March 2009).

- Guest editor of a special issue of Journal of Computational and Applied Mathematics, devoted to the Third International Workshop on Analysis and Numerical Approximation of Singular Problems (JCAM, Vol. 234, September 2010).

- Guest editor of a pecial issue of Applied Numerical Mathematics, devoted to the 5th International Workshop on Analysis and Numerical Approximation of Singular Problems (Appl. Num. Math., Vol. 114, January 2017).

- Guest editor of a special issue of Applied Numerical Mathematics, devoted to the 6th International Workshop on Analysis and Numerical Approximation of Singular Problems (Appl. Num. Math., Vol.149 , January 2020).

- Editor of the Proceedings of the International Conference 'Modeling of Nonlinear Processes and Systems' (MNPS-2020), published in EPJ Web of Conferences Vol. 248 (2021), https://www.epj-conferences.org/articles/epjconf/abs/2021/02/contents/contents.html.

- Reviewer for about 20 international journals, registered at publons (https://publons.com/researcher/741973/pedro-m-lima/peer-review/)

- Contributed to "Mathematical Reviews", from the American Mathematical Society.

3.4.3 Participation in Scientific and Program Committees of Conferences

- V International Congress on Mathematical Modeling, Dubna (Russia), 30 September-6 October 2002.

- VI International Congress on Mathematical Modelling, Nizhny Novgorod (Russia), 20-26 de September 2004.
- International Conference on Modeling of Nonlinear Processes and Systems (MNPS), in Moscow, 2008, 2011, 2015, 2018, 2019, 2020.
- International Conference on Differential and Difference Equations and Applications, Universidade dos Açores, July 2011.
- International Workshop on Analysis and Numerical Approximation of Singular Problems, Cagliari (Italy), 4-6 Setembro 2018.
- Russian Conference on Functional Analysis and Mathematical Education (FAMO-2020), Ulianovsk (Russia), October 2020.

3.4.4 Invited Talks in Seminars

- "Extrapolation methods and their applications", at the *Instituto de Ciências Matemáticas*, S.Carlos, Universidade de S.Paulo, Brasil, 3/9/97.
- "Numerical solution of nonlinear singular boundary-value problems using variable substitutions", *Computing Center of the Russian Academy of Sciences*, Moscow, 7/9/00.
- "Numerical approximation of singular boundary value problems for the Emden-Fowler equations" Dep. Mathematics of Universidade da Beira Interior, 16/2/00.
- " Numerical methods for singular boundary value problems for the Emden-Fowler equations" Dep. Mathematics of Universidade de Coimbra, 21/6/00.
- "Analysis and numerical approximation of a singular boundary value problems", Dep. Computer Sciensce and Statistics, Instituto de Ciências Matemáticas de S.Carlos, Universidade de S. Paulo, Brasil, 21/10/2003.
- "Computational methods for a non-uniquely solvable Volterra integral equation", Department of Mathematics, University of Chester, UK, 29/04/2004.

- "Numerical and Asymptotic Analysis of Nonlinear Boundary Value Problems with Bubble-type Solutions", Dep. Mathematical Sciences of the University of Kyushu (Japan), 10/04/07.

- "Numerical and Asymptotic Analysis of Nonlinear Boundary Value Problems with Bubble-type Solutions", at the Department of Mathematics of the University of Hiroshima (Japan), 11/04/07.

- "Analysis and Numerical Approximation of Singular Boundary Value Problems Involving the One-dimensional p-Laplacian", seminar of CMAF, Universidade de Lisboa, 17 de Abril de 2008.

- "Mixed-Type Functional Differential Equations: Analysis and Computational Methods ", Department of Mathematics, Universidade de Coimbra, 3/3/2010.

- " Analysis and numerical modelling of singular boundary value problems for nonlinear ordinary differential equations", seminar of Mathematics, Faculty of Sciences of Universidade do Porto, 16/12/2011.

- "Forward-backward equations and numerical modelling of propagation of nerve impulses", seminar of Differential Equations and Numerical Analysis, Universidade Nova de Lisboa, 1/2/2012.

- "Mathematical Modelling in Nerve Conduction", seminar on Probability Theory and Mathematical Statistics of the Johannes Kepler University, Linz, 22 /4/2015.

- "Numerical simulations of neural field equations with delays", seminar of *Laboratoire de Recherche en Mathematiques Apliquées*, Ecole Normale de Constantine (Algeria), 9/2/2017.

- "Computational methods for two-dimensional neural field equations", seminar of the Group of Functional Analysis and Applications, Universidade de Aveiro, 16/2/2017.

- "Effective numerical solution of neural field equations", seminar on Analysis, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 7/6/2017.

- 'The Mathematics of Brain', Coóquio do Departamento de Matemática do IST, 9/11/2017.
- 'The mathematics of Brain', seminar of Mathematics (online) of the University of Grodno (Bielorrussia), 20/11/2017.
- 'The mathematics of Brain', seminar Mathematics (online) of the Moscow State Technological University (Stankin), 6 /12/2017.
- "Numerical solution of the two-dimensional neural field equation", Seminar of the research center in Mathematics, Universidade de Évora, 22/11/2017.
- "Neural modeling: numerical methods and applications", *Seminar of Stochastic Models in Economics*, Institute of Mathematical Economics, Russian Academy of Sciences (Moscow), 9 /10/2018.
- "Numerical methods for the neural field equations and their applications", seminar on *Modern Problems of Artificial Inteligence*, Moscow University of Technology Stankin (Moscow), 8/10/ 2018.
- "Numerical Approach to Stochastic Neural Field Equations", *Seminar of Stochastic Models in Economics*, Institute of Mathematical Economics, Russian Academy of Sciences (Moscow), 14/02/2019.
- "A Stochastic Model of Working Memory Using Neural Fields". Seminar of the Faculty of Mathematical Sciences, University of Mazandaran, Babolsar, Iran, 14 /12/ 2020 (online).
- "Mathematical modeling of working memory in the presence of random disturbanse using neural field equations", University of Marageh, Iran, 15/6/2022.
- "Stochastic neural field equation and applications to working memory, Seminar of the Faculty of Mathematical Sciences, University of Mazandaran, Babolsar, Iran, 21/6/2022.
- "A Matemática do Cérebro", Seminário do Departamento de Matemática e Computação , Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Brasil, 8/7/2022.

- "Working Memory and Neural Field Equations: a Stochastic Approach", Seminário do Instituto de Ciências Matemáticas de São Carlos, Brasil 20/07/2022.

- Numerical solution of the stochastic neural field equation and applications to working memory, Seminar of Analysis, Faculty of Sciences and Technology, Universidade Nova de Lisboa, 27/04/2023.

3.4.5 Invited Talks in Scientific Events

- "Numerical methods and asymptotic expansions for singular boundary value problems", em XIII Crimean Autumn Mathematical School-Symposium, Laspi (Ucrânia), 17-28 September 2002.

- "Numerical solution of a singular boundary-value problem in non-newtonian fluid mechanics", in 5th International Congress on Mathematical Modeling, Dubna (Russia), 30 Setember-6 de October 2002.

- "Mathematical analysis and numerical solution of a singular problem in nonlinear physics", VI International Congress on Mathematical Modelling, Nizhny Novgorod (Russia), 20-26 de September 2004.

- "Asymptotic and Numerical Analysis of a Singular Boundary Value Problem for a Quasilinear Ordinary Differential Equation", e International Conference on Modeling of Nonlinear Processes and Systems, Moscovo (Russia), 14-18 October 2008.

- "Analysis and Numerical Solution of Backward-Forward Functional Equations", New Approaches in the Analysis and Numerical Solution of Differential and Integral Equations, 9-13 August 2010, Olkhon (Russia).

- "Differential Equations with Bubble-Type Solutions - Analysis and Numerical Simulations", em Encontro no Douro : Differential Equations and Applications, Folgosa do Douro, Portugal, 2-4 October 2010.

- "Mathematical and Numerical Modeling of Bubbles", International Conference on Mathematical Fluid Mechanics and Biomedical Applications, Ponta Delgada, 31 May-4 Jne 2011.

- "Computational Methods for a Mathematical Model of Propagation of Nerve Impulses in Myelinated Axons", in International Conference on Modeling of Nonlinear Processes and Systems, Moscow (Russia), 6-10 June 2011.

- "Numerical Solution of the Two-dimensional Neural Field Equation", in International Conference on Modeling of Nonlinear Processes and Systems, Moscow (Russia), 22-26 June 2015.

- "Effective Numerical Methods for the Two-dimension Neural Field Equations", Second International Conference on Modern Mathematical Methods and High Performance Computing in Science and Technology, Ghaziabad (India), 4-6 January 2018.

- " Numerical approach to Neural Field Equations in the presence of random disturbance". International Conference on Modeling of Nonlinear Processes and Systems", Moscow, Russia, October 15-17, 2019.

- "Applications of neural field equations to working memory". VII International Conference on Mathematics, its Applications and Mathematical Education (MAME 20), Ulan- Ude (Russia), September 2020 (online).

- "Mathematical modeling of working memory using neural field equations", Russian Conference on Functional Analysis and Mathematical Education, Ulianovsk (Russia), 8-9 October 2020 (online).

- 'Mathematical Modeling of Working Memory in the Presence of Random Disturbance using Neural Field Equations', Fifth International Conference on Modeling of Nonlinear Processes and Systems, Moscow, 16-20 November 2020 (online).

- 'Numerical Solution of Stochastic Differential Equations and Applications to Working Memory', International Conference on Qualitative Theory of Differential Equations, Moscow, 27-28 December 2020 (online).

- 'Mathematical Modeling of Brain', Winter School in Mathematics, IST, Lisbon, 22-26 February 2021 (online).

- 'Numerical Approximation of One- and two- dimensional Stochastic Neural Field Equations with Finite Propagation Speed', Samarski Readings, Moscow, 22 December 2021 (online).

- 'Numerical approximation of one- and two- dimensional stochastic neural field equations with finite propagation speed', Petrovski Conference on Differential Equations and Related Topics, Moscow State University, 27-30 December 2021 (online).

- ' Working memory and neural field equations: a stochastic approach', The International Conference Challenges in Numerical Analysis and Scientific Computing (CNASC 2022) 5-6 September, 2022 at the University of Minho, Braga, Portugal.

4 Knowledge Transfer

4.1 Organization of International Conferences

Together with Prof. T. Diogo, P. Lima was the initiator of a series of international conferences with the name International Workshop on Analysis and Numerical Approximation of Singular Problems (IWANASP). Up to now, this conference was organized 6 times. The list of these events follows:

- IWANASP 2004 (Lisbon):
http://www.math.ist.utl.pt/∼ plima/IWAN/

- IWANASP 2006 (Samos):
http://userweb.port.ac.uk/∼makroglo/conf/IWANASP06/samos06.html

- IWANASP 2008 (Ericeira):
http://www.math.ist.utl.pt/∼ tdiogo/IWANASP2008/

- IWANASP2011 (Chester):
http://www.stochasticdelay.org.uk/IWANASP2011homepage.html

- IWANASP 2015 (Lagos) :
http://www.math.ist.utl.pt/∼ tdiogo/IWANASP015/

- IWANASP 2018 (Cagliari):
https://bugs.unica.it/iwanasp18/

- IWANASP 2023 (Peso da Régua, Portugal) to be held on 12-14 October 2023,
  https://iwanaspconference.wordpress.com/

4.2 Organization of Mini-Symposia in Conferences

- "Numerical Approximation and Extrapolation Methods for Differential Equations and Volterra Integral Equations", in International Conference on Numerical Analysis and Applied mathematics (ICNAAM2010), Rhodes (Greece), September 2010.
  Webpage: www.math.ist.utl.pt/∼plima/ICNAAM2010.

4.3 Coordination of Seminar

From 2007 to 2014, Coordinator of the seminar on Applied Mathematics and Numerical Analysis, Department of Mathematics of IST.

4.4 Translation of Scientific Books

A list of books in Physics and Mathematics, translated from Russian to Portuguese, can be found in Sec. 2.5.

5 University Management

5.1 Administrative Duties

- From January 1999 to January 2001, Coordinator of the Undergraduate Course in Applied Mathematics and Computation, IST.
- From January 2002 to January 2007, represented the section of Numerical Analysis and Applied Analysis at the Coordinating Comission of the PhD Program of Mathematics at IST.
- From December 2006 to December 2008, Coordinator of the Section of Numerical Analysis and Applied Analysis of the Department of Mathematics of IST.
- From January 2017 to December 2020, member of the Executive Comission of the Department of Mathematics of IST.

- Since July 2021, Coordinator of the Section of Numerical Analysis and Applied Analysis of the Department of Mathematics of IST.

5.2 Participation in Juries

- Defense of MSc Thesis of Ana Cristina Lemos, Instituto Superior Técnico, 1995.
- Defense of MSc Thesis of Maria Isabel da Conceição Santos, Instituto Superior Técnico, 1996.
- PhD defense of Mário Meireles Graça, Instituto Superior Técnico, 1997.
- Defense of MSc Thesis of Magda Stela of Jesus Rebelo, Instituto Superior Técnico, December 2002.
- PhD defense of António Fernandes Oliveira, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2003.
- Defense of MSc Thesis of Matilde Pós-de-Mina Pato, Instituto Superior Técnico, 2003.
- Defense of MSc Thesis of Maria Madalena Correia Consciência, Faculdade de Ciências da Universidade de Lisboa, April 2005.
- Defense of MSc Thesis of Luis Jorge Carmelo Silva, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, April 2006.
- Defense of PhD Thesis of Luis Borges, Instituto Superior Técnico, Dezembro de 2006.
- Defense of PhD Thesis of Maria Luisa Ribeiro Morgado, Universidade de Trás-os-Montes e Alto Douro, February 2008.
- Defense of MSc Thesis of Ana Sofia Rézio Moreira da Silva, Faculdade de Ciências da Universidade de Lisboa, April 2008.
- External Examiner of PhD in Mathematics of Stewart Norton, University of Chester (Reino Unido), May 2008.
- Defense of PhD Thesis of Magda Stela de Jesus Rebelo, Instituto Superior Técnico, July 2010.

- Defense of PhD Thesis of Manuel Faria Cruz, Faculdade de Ciências da Universidade do Porto, Februar 2011.
- Defense of PhD Thesis of Maria Filomena Teodoro, Instituto Superior Técnico, July 2012.
- Defense of PhD Thesis of Cidália Alves das Neves, Faculdade de Ciências e Tecnologia da Universidade de Coimbra, March 2014.
- Defense of PhD Thesis of Flora da Rocha Ferreira, Escola de Ciências da Universidade do Minho, May de 2014.
- Defense of PhD Thesis of Alexandra Gavina, Faculdade de Ciências da Universidade do Porto, February 2016.
- Defense of PhD Thesis of Hanane Kaboul, Université Jean Monnet, Sait-Etienne (France), June 2016.
- Defense of PhD Thesis of Maryam Ghalati, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, February 2017.
- Defense of PhD Thesis of Marcelo da Silva Trindade , Faculdade de Ciências da Universidade do Porto, 2017.
- Defense of PhD Thesis of Bilal Boulfoul, HNS Kouba, Algiers (Argélia), December 2020.
- Defense of PhD Thesis of Weronika Wojtak, University of Minho, September 2021.
- Defense MSc Thesis of Guilherme Varela, IST, November 2022.
- Defense MSc Thesis of Tomás Freire, IST, December 2022.

Lisbon, 24 May 2023