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CIMA's Scientific Report

2020

Contents

I.Overview of research activities in 2020	3
II.Research Groups	3
1.Differential Equations and Optimization (DEO)	3
2.Logic, Algebra and Geometry (LAG)	6
3.Dynamical Systems (DS)	7
4. Statistics, Stochastic Processes and Applications (SSPA)	8
III.Research Lines:	12
Complex Systems (CS)	12
Mathematical Modelling in Life Sciences and Industry Applications (MMLSIA)	12
2020 Indicators	15
A – Publications	15
B – Communications	27
C – Reports	31
D – Organization of conferences and seminars	32
E – Advanced training	34
H – Invited talks and seminars	
I. Projects and scientific contracts	40
Summary of CIMA 2020 indicators	42

Scientific Report of CIMA

2020

I.Overview of research activities in 2020

In 2020, (last official actualization up to 31st December 2018) the team of the Research Center in Mathematics and Applications (CIMA) was composed by 67 members: 60 PhD integrated researchers and 7 non PhD integrated researchers.

The scientific research developed in CIMA was addressed on several topics according to the different four research groups (DEO, LAG, DS, SSPA) and two interdisciplinary research lines (CS, MMLSIA).

In what follows we give a brief description of the obtained results:

II.Research Groups

This section contains the main scientific topics in each research group.

1.Differential Equations and Optimization (DEO)

1.1.<u>Boundary value problems for ordinary differential equations</u>

- Studying of the boundary value problems for high order ordinary differential equations on the real half-line or on the whole number line: the non-linear and functional cases.
- Proving of the existence of homoclinic solutions to both second and fourth order problems.
- Proving of the existence of heteroclinic solutions to semi-linear boundary value problems of the high order.

- Studying of the Hammerstein type integral equations on bounded and unbounded domains. Research of the various cases: when the kernel is either continuous or discontinuous; when it admits a constant or variable sign.
- Studying of the systems of coupled differential equations of the high order with nonlinearities depending on the derivatives of the unknown functions. Application of the results to double systems of mass-spring and of two coupled beams.
- Studying of the impulse problems on compact and non-compact domains, with finite or infinite impulse moments, and with generalized impulse conditions. Applying of the results to homeostatic thyroid-mucous mechanism.
- Spectral analysis of the proper values problems of the high order.
- Sufficient conditions for the solvability of different types of coupled systems on bounded and unbounded intervals, including the periodic and functional ones.
- Multipoint resonant problems.
- Heteroclinic and homoclinic solutions.
- Generalized Hammerstein equations

1.2. Calculus of Variations and Optimal Control

- Generalizations of the Lyapunov theorem on convexity of the range of a non-atomic vector measure.
- Decomposition of an absolutely continuous function into piecewise-cap/cup components. Applications to Lebesgue integration and to Calculus of Variations or Optimal Control.
- Developing of the dimensional reduction approach for multi-structures and in the Orlicz-Sobolev setting.
- Proving of the various integral representations in BV and Lebesgue spaces, in particular, for the Gap problem.
- Proving of the Integral as well as supreme representations for functionals with convex constraints
- Studying of the equilibrium problems for hyper-elastic materials.
- Studying of the optimal design problems for fractured materials with prescribed strain.
- Studying of a vector Variational problem with knitting boundary conditions and its application in the plastic surgery.

1.3.<u>Non-smooth Analysis</u>

• Studying of correlations between strongly and weakly convex subsets of a Hilbert

space in the non-uniform setting

1.4. Mathematical models of Fluid Mechanics and Applications

- Development of an algorithm of pressure-correction for compressible fluids at all levels of Mach number with co-located finite volume space discretization. Computational implementation in 1d and 2d using Fortran programming.
- Mathematical analysis and numerical methods for Partial Differential Equations modelling the Fluid Mechanics processes. Development and analysis of 1D models (in particular, obtained via Cosserat theory) for straight and curved pipes, and their applications to hemodynamics.
- Analysis of the (in)dependence of a numerical method (of the finite elements/volumes) of the reformulation presented by Saramito on the Log-Conformation.
- Developing of an algorithm and its implementation into Python for IFR (with the instant wave-free ratio or with instant flow reserve). It was considered as a diagnostic tool for estimate whether a stenosis is the reason for blood escapement in coronary arteries with the subsequent ischemia.

1.5.<u>Numerical methods for Optimal Control and Multi-criteria Problems with</u> <u>Applications to regional challenges</u>.

- Analysis of an optimal control problem for a system of two hydroelectric power stations in cascade with reversible turbines where the profit of power production should be optimized under some system's restrictions reducing to the state constraints assuming the non-convexity of the cost function. The problem is solved numerically, and two different approaches are adopted. They focus on global optimization techniques (Chen-Burer algorithm) and on a projection estimation refinement method (PERmethod). Results and execution time of the two procedures are compared.
- A framework was proposed for obtaining homogenous territorial clusters based on a max-p-regions optimization problem by considering multiple criteria related to endogenous resources, economic profile and socio-cultural features of territories. This framework is developed in three steps. First, the dissimilarity criteria correlated with development at the territorial unit level are identified, using a multiple linear regression analysis. Then, a multi-criteria max-p-regions model is developed, in order to allocate each territorial unit (parishes) to a territorial agglomerate. Finally, the max-p-model is used to generate alternative efficient district maps according to the changes in the threshold of spatial attributes.
- Studying of the forested landscape-level management, planning and the provision of ecosystem services. The research focused on the potential of combining participatory workshops and multiple criteria decision methods (MCDMs) to support the development and negotiation of targets for the supply of ecosystem services and help design the management plan needed to meet those targets. The results are applied to

two forested landscapes with several ownership types in Portugal. The approach encompassed the design of two workshops involving more than 40 stakeholders (forests owners, the forest service, the forest industry, local municipalities and other nongovernmental organizations). The list of ecosystem services included carbon stocks, cork, pine cones, and forest inventory at the end of the planning horizon as well as volume flows from a range of forest species. Results demonstrated the potential of MCDM tools to help individual forest stakeholders set and adjust ecosystem services target levels. They further demonstrated the potential of MCDMs to facilitate the negotiation of these targets by the stakeholders and the reaching of meaningful solutions. Finally, they demonstrated that these tools provide valuable information to combine the negotiations of both targets and behaviors and programs needed to attain them.

2.Logic, Algebra and Geometry (LAG)

2.1. Logic of belief change

- Definition and axiomatic characterization of (new) operators of belief change bases that consist of the adaptation for the context of the belief bases (ie sets of sentences not necessarily logically closed) of operators (of change of theories) designated in the literature by shielded contractions and by credibility-limited revisions;
- Definition and characterization of (new) belief change operators appropriate to the context in which the underlying logic is a paraconsistent logic.

2.2 Jordan type of Artinian algebras

• Applications of Jordan type to free extensions .

Construction of examples of families of Artinian Gorenstein algebras with given Hilbert function having at least two irreducible components.

• Skew-symmetric decompositions

We introduced the "skew apolarity lemma" and we use it to give algorithms for the skewsymmetric rank and the decompositions of tensors in the exterior power of a vector space of dimension at most 8, with degree at most 3. We also presented new algorithms to compute the rank and a minimal decomposition of a tritensor.

• Finite determinancy of matrices

Necessary and sufficient conditions for a 2x2 matrix to be finitely G-determined (joint with Thuy Huong Pham).

2.3. <u>Study of monads on smooth projective varieties</u>

Study of monads on smooth projective varieties whose bounded derived category of coherent sheaves has a semi-orthogonal decomposition

2.4. <u>Vector bundles on the 3-dimensional projective space</u>

Existence of vector bundles E on the 3-dimensional projective space defined by a linear resolution and homological dimension 2, and such that the Euler characteristic of the bundle End(E) is one.

2.5. <u>Finite Monoids</u>

In abstract algebra, a monoid is a set equipped with an associative binary operation and an identity element.

Monoids are semigroups with identity. We study in particular Numerical semigroups, that are, a co-finite submonoids of the monoid of the non-negative integers. Such algebraic structures occur in several branches of mathematics.

3.Dynamical Systems (DS)

- **3.1.** Methods for the analysis of complex motion in biology and robotics, using symbolic dynamics and iterated maps of the interval, were developed. The topological invariants were used to classify and to characterize types of motions and its global geometric features.
- **3.2.** The classification of invariant subshifts of finite type of a given subshift was achieved and a paper submitted. The result allows the classification of sub algebras of Cuntz-Krieger algebras which are Cuntz-Krieger. Further developments relating the obtained result with the K-theory of the Cuntz-Kriger subalgebras are being pursued.
- **3.3.** Methods of statistical mechanics were used to study the vibrations on nonhomogeneous materials to deal with large types of distinct oscillators, coupled in an irregular manner. These methods are used on the project BROQ to study mechanical vibration on rocks and to infer the existence of heterogeneities.
- **3.4.** Results on the convergence rates for sequences of bifurcation parameters of nonautonomous dynamical systems generated by flat top tent maps, were obtained.

- **3.5.** Machine learning methods were used in applications to human health care and industrial problems.
- **3.6.** Continuation of the study of the coupling of chaotic dynamical systems, focusing mainly in the suppression of the chaotic behavior and synchronization.
- **3.7.** Use of a network of networks to create a trustful model of the spreading of forest fires.
- **3.8.** Discrete dynamical systems defined on spaces of networks to study dynamical networks, digraphs which change in time. The global coordinate system for networks was used to analyze large complex networks.
- **3.9.** Use of cellular automata systems to study traffic flow (variants of Nagel-Schrakenberg model) and to study characteristics of marble blocks within BROQ project. Use of genetic algorithms for cellular automata and probabilistic formulation was developed.
- **3.10.** Study of higher dimension dynamical systems through iterated maps of the interval: A nonlinearly perturbed heat equation and an hybrid system.

3.11. Bifurcations of real rational maps and discrete dynamical systems with applications to Population dynamics

- **3.12.** Applications to geophysics.
- **3.13.** Study of combinatorial game theory.

3.14. Use of Dynamical Measurements of Complex Networks for The authorship of Historia Augusta.

4. Statistics, Stochastic Processes and Applications (SSPA)

4.1. <u>Fractional calculus and grey Brownian motion</u>

- Mathematics and physics of fractional polymer models: clarification of the long range interaction energy in fractional bead-spring-models, extension of this to a larger class of non-Gaussian stochastic processes ("generalized gray Brownian motion")
- Models of cyclic and branched polymers, based on fractional Brownian loops and fBm on metric trees. In particular the existence of weakly self-avoiding variants ("Edwards model") of these processes has been proven mathematically (to be published). An unexpected singular dependence of the "universal amplitude ratio" as a function of the Hurst index around H=0.3

was proved.

- Form factors of paths for a class of non-Gaussian processes, characterized in terms of the Mittag-Leffler function. In particular, a closed analytic form for the form factors, the Debye function, was obtained, which allows the study of their asymptotic decay.
- The potential for a class of non-Gaussian processes so-called generalized grey Brownian motion was investigated. It was obtained a closed analytic form for the potential as an integral of the M-Wright functions and the Green function. In particular, the special cases of Brownian motion and fractional Brownian motion were recovered.
- In addition, it was given the connection to a fractional partial differential equation and its fundamental solution. The long time behavior of solutions to fractional in time evolution equations which appear as results of random time changes in Markov processes was studied. It was considered inverse subordinators as random times and it was used the subordination principle for the solutions to forward Kolmogorov equations. The class of subordinators for which asymptotic analysis may be realized and it was described.

4.2. <u>Development of systems to prevent environmental risks due to floods and fires.</u>

• Precipitation measurement systems were developed, based on the quality of telecommunications connections, and the implementation of low-cost systems for video surveillance of flows and fires.

• Installation of two stream monitoring systems and test system based on LoRa radios for long communication range.

4.3. <u>Regression models and nonparametric two-way ANOVA</u>

- Study the efficiency of NIR technology for evaluating fruit ripeness and quality.
- Study of the Type I error and power of the nonparametric two-way ANOVA with balanced designs. Difficulties in nonparametric two-way ANOVA with missing cells.
- Analysis of pine tree attributes, cone, pine nuts and kernel data with regression models and nonparametric tests.
- Analysis of the relative abundance of the Azorean Buzzard and responses to land use.
- Experimental design to evaluate the durability of different materials, subjects at the same effort in olive harvesting.

4.4. <u>Modeling and prediction of road traffic accidents in the district of Setúbal</u>

Coordination of the funding FCT project with GNR named "MOPREVIS, Modeling and prediction of road traffic accidents in the district of Setúbal". This project has a multidisciplinary research team that integrates computer engineers, specialists in geographic information systems (GIS) and mathematicians with specialization in probability and statistics, to: i) construct an information system about the accidents occurred in the district of Setúbal, combining several sources of information: digital platform (storage solution, large scale data processing and management with distributed architecture), data acquisition module (module for extracting

information from accident documents with automatic processing techniques of natural language and artificial intelligence and interface module for other systems, namely automatic data acquisition on traffic intensity in adjacent streets and climatic data) and module for information recover; ii) classify sites with high number of accidents (hotspots); iii) identify the determinants factors that potentiate the occurrence of accidents and their severity; iv) draw the profile of the individuals involved, comparing it by type (collision, trampling or scraping); v) construct predictive models for the number and severity of accidents, as well as for the most likely places for its the occurrence, and also to obtain a model that can predict an accident given a road segment and given a time period. The final objective is to build a digital tool to support real-time decision making. Such a tool will be based on the models obtained and will have the ability to readjust its parameters and update the predictions whenever new data are obtained. .

4.5. <u>"Diagnóstico Juvenil do Município de Évora" (a project with Câmara Municipal de Évora)</u>

This study aimed to answer three main questions about young people (from 15 to 29 years) who live, study or work in the Municipality of Évora: i) who are they; ii) how do they live the present; iii) what do they look forward?

For these young people we characterized different dimensions of their life on:

i) sociodemographic profile; ii) ways of school participation (and also professional insertion, when applicable according to age); iii) sociocultural practices; iv) civic intervention practices; v) risk behaviors; vi) level of satisfaction with life and ideas for the future. The achieved results will allow CME to draw its Youth Municipal Plan.

4.6. <u>"Hábitos de Atividade Física e desportiva e Hábitos do Sono das Crianças do 1º</u> <u>Ciclo do Ensino Básico do Concelho de Évora"</u>

This project tries to: i) characterize the children of the schools of the 1st Cycle of Basic Education of the Municipality of Évora, as well as the household of the person in charge of education; ii) evaluate the sleep pattern and the physical and sporting habits of each child. It will allow to analyze the evolution of sleep and physical activity habits in a period of 3 years, evaluating the consequences of alerts and interventions developed by the research team.

4.7. <u>Analysis of the data from AdolesSer Project, on a collaboration with</u> <u>Agrupamento de Centros de Saúde do Alentejo Central (ACES)</u>

The aim of this topic is to evaluate the performance of the ACES interventions which address the knowledge, behaviour and attitudes about the sexual and reproductive health of 6th and 9th grade students of Évora schools.

4.8. <u>Applications of statistical methods and techniques of data analysis</u>

- Statistical modelling of different data form different areas: biological, behaviour and animal production, healthcare, epidemiology.
- Comparison of different methods for analyzing tidal records.
- Characterization of the mineralization features of the canine mammary gland. Findings support the use of this spontaneous animal model for the study of human breast cancer, considering how clinically relevant microcalcifications are in humans.
- Evaluate the impact of depressive symptoms in the quality of life (QoL) of patients with breast cancer undergoing chemotherapy and monoclonal antibodies treatments. The study

provided evidence that depressive symptoms in patients with breast cancer undergoing chemotherapy and monoclonal antibodies treatments detrimentally reduced various aspects of QoL.

- Data analysis and applications of Binary response models with ordinal covariates in time; Random mixed model effects for clustered ordinal responses; and analysis of ordinal categorical data and nonparametric hypothesis testing.
- Impact of habitat fragmentation on social and mating systems: testing ecological predictions for a monogamous vole through non-invasive genetics
- Effects of road verges and paved lanes on the fine-scale landscape connectivity for the wood mouse (Apodemus sylvaticus) in a well-preserved Mediterranean woodland. The connectivity is quantified using graph theory based on two years of capture-recapture data, comparing connectivity metrics (derived from the probability of connectivity index) in a road area and in a virtual roadless scenario. It is emphasized the critical role of road verges and suggest important management options to enhance landscape connectivity for small mammals.

4.9. <u>Stochastic differential equation models</u>

- Extension of the stochastic differential equation models (to account for the environmental variability) of bovine individual growth developed at CIMA to mixed models with parameters depending on the animal genetic values (available at the GENPRO database).
- Adjustment of the models to males of mertolengo and Alentejano breeds.
- Development of estimation methods to reduce the size at maturity parameter bias due to the reduced number of observations at larger ages.
- First developments, in cooperation with the producer's associations and zootechnical colleagues, of a simple and reasonable profit function for animal production.
- Study of stepwise fishing policies and its optimization for stochastic differential equation models on fisheries;
- Study of an optimal penalized variable effort fishing policy for stochastic differential equation fishing models, where the penalty is designed to tame the wild variability of the non-penalized optimal policy. For the Gompertz stochastic model, the two mentioned policies and the easily applicable and sustainable constant effort policy were compared using real data.
- Impact of Allee effects on stochastic differential equation models of fisheries, particularly in what concerns extinction, existence of a stationary density. Also, preliminary results on the impact of Allee effects on extinction time and profit optimization of stochastic fishery models have been obtained.

4.10. <u>Realization, maintenance and dissemination of measurement standards in</u> <u>Portugal through National Metrology Laboratory of Portuguese Institute of Quality</u>

- Realization and maintenance of the primary measurement standards, which includes a scientific component of fundamental and applied research with participation in research projects, publications and international representation;
- Dissemination of primary measurement standards and support to the network of national accredited laboratories to maintain the traceability of national measurements to the International System of Units.

III.Research Lines:

Complex Systems (CS)

During 2019, the development of symbolic dynamics for the study of complex systems continued:

- (1) at the theoretical level, with the writing, in progress, of the book Complex systems symbolic dynamics, which supports the course Complex Systems.
- (2) in terms of applications with an article published on the complex movement of animals or agents, another submitted on the same subject. Study of chaos in food chains.
- (3) on the experimental plane with the development of techniques for the direct application of symbolic dynamics in experimental sciences and in the study of chaos. In particular, for the study of time series, relating the physical and biological aspects in ecology: humidity, temperature, number of species in a region, interactions, etc. An experimental device was developed for the study of minimal ecological systems. A chaotic pendulum prototype has been perfected that will allow the study of topological invariants in mechanical and thermodynamic systems, with the aim of clarifying the physical sense of topological invariants and with the aim of starting the study of non-equilibrium thermodynamics based on symbolic dynamics.

Mathematical Modelling in Life Sciences and Industry Applications (MMLSIA)

The research in the framework of the interdisciplinary project "Mathematical Modelling in Life Sciences and Industry Applications" is composed by research tasks inside the Research Groups according there plan of activities, and by autonomous activities with other Research Centers or related projects.

The main research goals were inside the CIMA Groups, namely :

Mathematical models of Fluid Mechanics and Applications;

Numerical methods for Optimal Control and Multi-criteria Problems with Applications to regional challenges;

Environmental Monitoring;

Productivity improvement in the system of bovine raising for meat ;

Stochastic differential equation models on fisheries;

From symptoms to diagnosis of Urban Tuberculosis ; Estimation of Internet flow size distribution ; Data analysis using Artificial Intelligence ; Academic performance in children and university students .

Outside CIMA Research Groups, other activities were also pursued, such as:

Statistics on Forest Sciences

The time horizon as well as the spatial scale of forest management planning determine that the respective decision processes are associated with risk and uncertainty. As a consequence, the estimation of the impacts of management options on the supply levels of ecosystem services must integrate risk considerations. In this context, research was developed with a view to the application of probabilities and statistics in forestry sciences in order to contribute to this integration. Specifically,:

a) We estimated the risk associated with catastrophic events (eg, forest fires in Portugal and the State of Oregon).

b) We estimated the probability of success of natural regeneration in forest ecosystems (eg in Pennsylvania). A new approach was introduced in the treatment and analysis of data on the process of natural regeneration of forest ecosystems through the development and application of the Tobit model. The estimation techniques used by this model allow us to consider more information and obtain more consistent parameters than the linear regression model.

c) We developed a computational implementation of Bayesian hierarchical space-time models in the study of the degree of forest fire severity in the state of Oregon.

In addition, for modeling the spatial part, it is necessary to develop computational tools in the R software that allow the complex connection with the ArcGis software.

This research is supported by the ongoing H2020 project with the title Models and decision SUpport tools for integrated FOrest policy development under global change and associated Risk and Uncertainty" and the national project with the title BIOECOSYS - Forest ecosystem management decision-making methods - an integrated bio-economic approach to sustainability. It involves collaboration with the Forest Service Pacific Northwest Research Station, Corvallis Forestry Sciences Laboratory in Corvallis, Oregon. (e.g., Kauberg et al., 2017, Botequim et al., 2017, Pinto et al., 2019).

Statistics in Medical Sciences

Research was developed with the aim of expanding the frontiers of knowledge, updating statistical methods and techniques to the experimental and observational sciences:

a) We conducted research to identify and evaluate risk factors in individuals with ischemic or hemorrhagic cerebrovascular accident (VTE) as well as risk factors that influence the survival time after stroke. It considered a sample of individuals who underwent a carotid triplex scan and a sample of individuals without stroke. It involved the analysis of several strategies of accomplishment of cervical scan and angio resonance considering the cost and the expected benefit.

b) We conducted research of spatiotemporal trends using the Baysian hierarchical models in the case of infectious diseases-AIDS and Tuberculosis and Stroke. This class of models is characterized by incorporating spatial and temporal effects in the modeling of the variability of incidence rates. With the implementation of these models it is possible to define patterns of spatial dependence, temporal trends and spatio-temporal interactions. In addition, it will be possible to identify the municipalities / parishes of mainland Portugal with the highest risk in relation to the country and the analysis of the county association with potential risk or exposure factors relative to the variable under study.

c) We conducted research of data mining and machine learning techniques to analyze the communication between neurons in patients with Alzheimer's disease.

5.2.3 <u>Extreme Value Statistics Modeling</u>

This topic has applications in the areas of Environment (extreme pollution), Hydrology (high levels of a river), Meteorology (heat wave,) Athletics (record time), among others.

a) We conducted research to analyze the limits of human in the case of various modalities of athletics. We considered the estimation of parameters of rare events through the use of extreme value models. In addition, we developed a new methodology to estimate the parameters underlying the model in particular the index of extreme values, a high quantil, the limit of the support (if it is finite) and the threshold. Modeling of stationary and non-stationary phenomena according to the "maximum block" methodologies, "r-greater ordinal statistics" and "excesses above a threshold" applied to various athletics specialties.

This research is supported by ongoing collaborations with the Applied Mathematics Research Center of the Faculty of Sciences and Technology of the New University of Lisbon and the Fluminense Federal University. It extends research documented in the report (eg, Caeiro, et al., 2018, Domingos et al., 2018).

2020 Indicators

A – Publications

A.1. Books

Books (author) of international circulation:

A1 Feliz Minhós, Robert de Sousa: Nonlinear Higher Order Differential and Integral Coupled Systems, Trends in Abstract and Applied Analysis, vol 10, World Scientific, ISBN: 978-981-122-512-3, 2021

https://doi.org/10.1142/11961

Books (author) of national circulation:

Books (editor) of international circulation:

A2 M. Aguiar, **C. Braumann**, B. Kooi, A. Pugliese, N. Stollenwerk, E. Venturino (editors). *Current Trends in Dynamical Systems in Biology and Natural Sciences*. SEMA SIMAI Springer Series (ISSN 2199-3041), vol. 21, Springer, xii+243 p., 2020, ISBN 978-3-030-41120-6 (eBook), <u>https://doi.org/10.1007/978-3-030-41120-6</u>

Books (editor) of national circulation:

A3 Luís M. Grilo, Ana Nata, Manuela Fernandes, Isabel Pitacas, **F. Carapau**, A. Manuela Gonçalves, Teresa A. Oliveira: VII Workshop on Computational Data Analysis and Numerical Methods, Instituto Politécnico de Tomar, (162pp), 2020 ISBN:978-989-8840-47-9

Book chapters of international circulation:

A4 Nuno M. Brites and Carlos A. Braumann. Harvesting policies with stepwise effort and logistic growth in a random environment. In: *Current Trends in Dynamical Systems in Biology and Natural Sciences* (editors: M. Aguiar, C. Braumann, B. Kooi, A. Pugliese, N. Stollenwerk, E. Venturino), SEMA SIMAI Springer Series, vol. 21, Springer, ISBN 978-3-030-41119-0, pp. 95-110, 2020, <u>https://doi.org/10.1007/978-3-030-41120-6</u>

- A5 Carmo, M. (2020). Entradas para o dicionário "Turismo e Hospitalidade de A a Z/Tourism and Hospitality from A to Z", Editores/Editors Antónia Correia and Áurea Rodrigues: "Amostra/Sample", "Estudos Quantitativos/Quantitative Research", "Estatística Descritiva/Descriptive Statistcs", "Estatística Inferencial/Statistical Inference" e "Probabilidade/Probability", Actual by Grupo Almedina, ISBN: 9789896945053.
- A6 Mendes, David José Murteira and Manuel José Lopes, José Manuel García-Alonso, Jorge Santos, and Luís Manuel Mota Sousa. "Resilient Software Architecture Platform for the Individual Care Plan." In Exploring the Role of ICTs in Healthy Aging. edited by David Mendes, César Fonseca, Manuel José Lopes, José García-Alonso, and Juan Manuel Murillo, 13-32. Hershey, PA: IGI Global, 2020. <u>http://doi:10.4018/978-1-7998-1937-0.ch002</u>.
- A7 Sousa, B., Pires, C., Gomes, D., Filipe, P.A., Costa-Veiga, A. and Nunes, C. (2020). Structured Additive Regression Modeling of Pulmonary Tuberculosis Infection. In: Proceeding of the 62nd ISI World Statistical Congress, vol. 3, pp: 225-233. Kuala Lumpur, Malasia, 18-23 de August, 2019. <u>https://2019.isiproceedings.org/Files/9.Contributed-Paper-Session(CPS)-Volume-3.pdf</u>
- A8 J. L. da Silva and M. Erraoui. Singularity of generalized grey Brownian motion and time-changed Brownian motion. In 9th Jagna International Workshop: Stochastic Analysis – Mathematical Methods and Real-World Models, pages 020002-1-11. American Institute of Physics, December 2020. ISBN: 9780735440166. http://aip.scitation.org/doi/abs/10.1063/5.0029913.

A.2. Scientific articles

Articles in international journals

- A9 F. Carapau, P. Correia, T. Rabczuk, P. Areias, One-dimensional model for the unsteady flow of a generalized third-grade viscoelastic fluid, Neural Computing & Applications, 32(16), pp.12881-12894, 2020
 https://doi.org/10.1007/s00521-020-04733-w
- A10 P. Areias, C. Tiago, J. Carrilho Lopes, F. Carapau, P. Correia, A finite strain Raviart-Thomas tetrahedron, European Journal of Mechanics/A Solids, Volume 80, article number 103911, pp.1-12, 2020 https://doi.org/10.1016/j.euromechsol.2019.103911

- A11 S. Marques, V. Bushenkov, A. Lotov, M. Marto, J.G Borges: Bi-Level Participatory Forest Management Planning Supported by Pareto Frontier Visualization, Forest Science, Volume 66, Issue 4, pp.490–500, 2020, <u>https://doi.org/10.1093/forsci/fxz014</u>
- A12 Sedmak, R.; Tuček, J.; Levická, M.; Sedmáková, D.; Bahýľ, J.; Juško, V.; Kašpar, J.; Marušák, R.; **Bushenkov**, V.A.: Optimizing the Tending of Forest Stands with Interactive Decision Maps to Balance the Financial Incomes and Ecological Risks according to Owner Demands: Case Study in Rakovník, the Czech Republic, Forests Science, Volume 11, pp.730, 2020, https://doi.org/10.3390/f11070730
- A13 Robert de Sousa, Feliz Minhós.: Existence and location of solutions to fourthorder Lidstone coupled systems with dependence on odd derivatives, Advances in Operator Theory 6, Article number: 10, 2021 , <u>https://link.springer.com/article/10.1007%2Fs43036-020-00105-2</u>
- A14 F. Minhós, J. Fialho, R. de Sousa, Periodic n dimensional first order coupled systems and periodic schizophrenia phenomena, Journal of Mathematical Analysis and Applications, Journal of Mathematical Analysis and Applications Volume 492, Issue 2, 15, 124482, 2020, https://doi.org/10.1016/j.jmaa.2020.124482
- A15 Feliz Minhós, Robert de Sousa, Solvability of coupled systems of generalized hammerstein-type integral equations in the real line, Mathematics, 8(1), 111, 2020, https://doi.org/10.3390/math8010111
- A16 N. Bedjaoui, J.M.C. Correia, Y. Mammeri, Convergence of a family of perturbed conservation laws with diffusion and non-positive dispersion, Nonlinear Analysis, Vol. 192, 111701, 15 pp., 2020, <u>https://doi.org/10.1016/j.na.2019.111701</u>
- A17 Bedjaoui, N., Correia, J.M.C., Mammeri, Y. On a limit of perturbed conservation laws with saturating diffusion and non-positive dispersion. Z. Angew. Math. Phys., 71, 59, 20 pp., 2020, <u>https://doi.org/10.1007/s00033-020-1279-8</u>
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A.3. Articles in Proceedings

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A.4. Edited special issues of journals

- A88 Special Issue "Intelligent Tools and Applications in Engineering and Mathematics", A special issue of Entropy (ISSN 1099-4300). This special issue belongs to the section "Multidisciplinary Applications". https://www.mdpi.com/journal/entropy/special issues/intelligent tools (J. Cabral)
- A89 Special issue Elsevier: 18th International Flow Measurement Conference FLOMEKO2019; Guest editors: **A. Ribeiro**, Elsa Batista, **J. Alves e Sousa**, M. Reader-Harris and Pier Giorgio Spazzini (<u>https://www.sciencedirect.com/journal/flow-measurement-and-instrumentation/vol/72/suppl/C</u>).
- A90 IOP Science Metrologia Focus Issue: Focus on Mathematics and Statistics for Metrology 2019. Guest editors: J. Alves e Sousa, A. Ribeiro, Isabel Godinho, Markus

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B – Communications

Communications at international events

- B1. F. Carapau, P. Correia, VII Workshop on Computational Data Analysis and Numerical Methods, 10-12 September de 2020, Instituto Politécnico de Tomar, Tomar, Portugal (Online Conference) Contributed Poster: One-dimensional theories to study three-dimensional problems: theoretical and numerical aspects, http://www.wcdanm.ipt.pt/pt/home/
- B2. V.Bushenkov, S.Marques, A.Lotov. The decomposition method in the multiple criteria integer programming forest management problem in Portugal. - XXII International Symposium on Mathematical Methods Applied to Sciences (XXII SIMMAC), February 25-28, 2020, San Jose, Costa Rica. <u>https://simmac.ucr.ac.cr/index.php/en/</u>
- **B3.** Marília Pires, On the Influence of Diffusion Stabilization in Oldroyd-B Fluid Flow Simulations. International conference on Topical Problems of Fluid Mechanics, Institute of Thermomechanics of the Czech Academy of Sciences, Praga, República Checa (Febray 19 21, 2020). <u>http://www2.it.cas.cz/fm/im/im/</u>
- **B4. Marília Pires**, MURPHYS-FM-2020, Interdisciplinary Conference on Multiple Scale Systems, Systems with Hysteresis and Fluid Mechanics, May 25 29, 2020, Canceled because SARS-COV-2, <u>http://conferences.math.slu.cz/murphys-fm-2020/index.php</u>
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- B6. Road Map For Bifurcations Of Real Rational Maps, "2nd International Conference on Mathematical Applications 19", Ponta Delgada, 8 -11 de julho de 2019. http://jcabral.uac.pt/ICMA2019_certificado_road_map.pdf
- B7. On the stability of 1d discrete dynamical systems: applications to Population dynamics,
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- B8. Investigating perched aquifers in volcanic terrains using tdem Geophysical exploration technique, "3rd International Conference in Engineering Applications 2019", Ponta Delgada, 8 -11 de julho de 2019. http://jcabral.uac.pt/ICEA2019_certificado_Investigating.pdf
- B9. eSMB 2020 online virtual meeting (Annual Meeting of the Society of Mathematical Biology, 17 – 20 August 2020, <u>http://smb2020.org/</u>. Carlos A.

Braumann (speaker), **Clara Carlos**, and Nuno M. Brites, General autonomous fishing models with Allee effects in a randomly varying environment. Abstract: <u>https://smb2020.org/POPD_Monday_MS2/#author3</u>.

- B10. VII Workshop on Computational Data Analysis and Numerical Methods, 10-12 September 2020, ONLINE hosted by Instituto Politécnico de Tomar, <u>http://www.wcdanm.ipt.pt/</u>. Nuno M. Brites and Carlos A. Braumann (speaker), Harvesting policies with stepwise effort in random environments. Abstract: "Book of Abstracts" (Editores: Luís Grilo *et al.*), Instituto Politécnico de Tomar, 2020, ISBN: 978-989-8840-47-9, p. 67-68, <u>http://www.wcdanm.ipt.pt/pt/program/book of abstracts/</u>
- B11. VII Workshop on Computational Data Analysis and Numerical Methods, 10-12 September 2020, ONLINE hosted by Instituto Politécnico de Tomar, http://www.wcdanm.ipt.pt/. Gonçalo Jacinto (speaker), Patrícia A. Filipe and Carlos A. Braumann, Individual Growth Modelling with Stochastic Differential Equations. Abstract: "Book of Abstracts" (Editores: Luís Grilo et al.), Instituto Politécnico de Tomar, 978-989-8840-47-9, 2020, ISBN: p.91-92, http://www.wcdanm.ipt.pt/pt/program/book_of_abstracts/.
- **B12.** Elsa Batista, **João Alves e Sousa**, Susana Cardoso, Vania Silverio, Flow accuracy and traceability in a lab-on-a-chip device, Congresso ANALITICA2020, Outubro2020, Online.
- **B13.** E. Batista, R. Mendes, A. Furtado, M. C. Ferreira, I. Godinho, **J. A. Sousa**, M. Alvarez, R. Martins (2020), Calibration of Syringe Pumps Using Interferometry and Optical Methods, congresso, ICMMS2020, October 2020, Online.
- **B14.** João Alves e Sousa, Thermal comfort application, EURAMET 17NRM05-EMUE project, M27 online meeting, Task A2.2.5, October 14, 2020.
- **B15.** João Alves e Sousa, Quantifying uncertainty in thermal comfort indices, LNE Workshop EMUE, LNE, 21-22 January 2020, Paris, France.
- **B16.** Daniela Duarte, Isabel Clímaco e **Manuela Larguinho**(speaker), Binge Watching, um novo padrão de consumo de video streaming entre os consumidores millennials?; In XXX Jornadas Luso-Espanholas de Gestão Científica.Cooperação transfronteiriça: desenvolvimento e coesão territorial; Bragança, Fevereiro de 2020.
- **B17.** Sofia Vieira, Isabel Clímaco e **Manuela Larguinho**(speaker), Fatores que influenciam a intenção de compra de online *groceries* em Portugal; In XXX Jornadas Luso-Espanholas de Gestão Científica.Cooperação transfronteiriça: desenvolvimento e coesão territorial; Bragança, Fevereiro de 2020.

B18. Lamy, E., Santos, V.,Barrambana, S., Simões, C. Carreira, L. **Infante, P**., Capela-Silva, F. (2020). Differences in salivary protein composition are related with inter-individual variation in bread sensory ratings, *EUROSENSE 2020: 9th European Conference on Sensory and Consumer Research*, 3-16 December, (online).

Invited communications at international events

- B19. Using Jordan type to determine irreducible components of families of local Artinian Gorenstein algebras of given Hilbert function, Lefschetz Properties in Algebra, Geometry and Combinatorics, Mathematisches Forschungsinstitut Oberwolfach, 28th September 2020, Pedro Macias Marques, https://www.mfo.de/occasion/2040a/www_view
- On the structure of short, grade-four, Artinian Goresntein algebras, Free **B20.** Resolutions and Representation Theory, Institute for Computational and Experimental Research in Mathematics (ICERM), Brown University, 6th August 2020, Pedro Macias Marques, (online talk. due to Covid-19 restrictions), https://icerm.brown.edu/topical workshops/tw-20-frrt/ https://icerm.brown.edu/materials/Abstracts/tw-20frrt/On the structure of short, gradefour, Artinian_Goresntein_algebras_]_Pedro_Marques, University_of_%C3%89vora. p<u>df</u>
- **B21.** Jordan type of an Artinian algebra, One-day conference: The combinatorics and geometry of Jordan type and commuting varieties, Northeastern University, 20th March 2020, Pedro Macias Marques, (online talk, due to Covid-19 restrictions), <u>https://sites.google.com/prod/view/nu-one-day-conference</u> <u>https://drive.google.com/file/d/1JmhJdWZrdUtG-pn5WiQhONthJmsH2eYx/view</u>
- **B22.** 17th International Conference on Principles of Knowledge Representation and Reasoning (KR 2020), September 12-18, 2020, Rhodes, Greece, <u>https://kr2020.inf.unibz.it/;</u> Fillipe Resina, Marco Garapa, Renata Wassermann, Eduardo Fermé and Maurício Reis, Choosing What to Believe New Results in Selective Revision, <u>https://proceedings.kr.org/2020/70/</u>
- **B23**. DSABNS 2020, 11th Conference on Dynamical Systems Applied to Biology and Sciences. 4-7 February 2020. Trento. Natural Italv. http://www.dsabns2020.maths.unitn.it/index.html. Nuno M. Brites and Carlos A. Braumann (speaker), Sub-optimal harvesting policies with stepwise effort in a random environment. Abstract: http://www.dsabns2020.maths.unitn.it/General Files/Braumann Carlos.pdf and "Book of Abstracts", ISBN: 978-989-98750-7-4, 41-42, p. http://www.dsabns2020.maths.unitn.it/General Files/Book dsabns2020 Feb17.pdf.

- B24. Ludwig Streit. 9th Jagna International Workshop: Stochastic Analysis Mathematical Methods and Real World Models. January 8 – 18. Research Center for Theoretical Physics ,Central Visayan Institute Foundation Jagna, Bohol6308, Philippines. https://spp-online.org/jagna2020/ "FRACTIONAL BROWNIAN MOTION -SOME RECENT RESULTS AND GENERALIZATIONS"
- **B25.** Ludwig Streit. Academia das Ciências de Lisboa workshop "Dialogues in Infinite Dimensional Analysis" 29. Setembro a 2 de Outubro de 2020 . <u>http://www.acad-ciencias.pt/agenda/evento/655</u>. "Self-Avoiding Random Trajectories Finding a Phase Transition?"
- **B26.** Random Time Change and Related Evolution Equations: Time Asymptotic Behavior, January 8-18, 2020, <u>https://spp-online.org/jagna2020/</u>, J. L. da Silva, Random Time Change and Related Evolution Equations: Time Asymptotic Behavior.
- B27. 2020 Mindanawan Math-Stat International Webcon, November 4, 11, and 18, 2020, https://www.msuiit.edu.ph/events/details.php?id=353#:~:text=The%202020%20Minda nawan%20Math-Stat,11%2C%20and%2018%2C%202020, J. L. da Silva, Asymptotic Behavior of the Subordinated Traveling Waves.
- **B28.** Webinar, Department of Mathematics, Caddy Ayyad University, Marrakech, April 15, 2020, J. L. da Silva, Asymptotic Behavior of the Subordinated Traveling Waves.

Communications at national events

- B29. Marília Pires, Encontro Nacional da SPM 2020, July 13-15, 2020, Canceled because SARS-COV-2 , <u>https://www.spm.pt/news/adiado-encontro-nacional-da-spm-2020</u>
- **B30.** Oliveira, M., Mexia, J. T., Garção, E., Grilo, L. M., (2020). COVID-19: How to estimate the percentages of asymptomatic and immune individuals. VII Workshop on Computational Data Analysis and Numerical Methods. Instituto Politécnico de Tomar, Portugal.
- B31. 1.ª Edição das Jornadas de Estatística Médica, 12-13 de fevereiro de 2020 Lisboa, URL: <u>https://jornadasem2020.wixsite.com/website-1</u>; Sousa-Ferreira, I., Abreu, A.M. e Rocha, C.S. Modelling gap times between recurrent events using restricted cubic splines.
- **B32.** Lopes, M., **Pereira, D. G.**, **Afonso, A.**, Melo, F. (2020). Variation in abundance of the Azorean Buzzard due to habitat changes. XXVII Meeting of the Portuguese Association of Classification and Data Analysis, 22 a 24 de outubro, Lisboa (*online*)
- B33. Silva, M. G., Nogueira, P., Infante, P., Costa, R., Quaresma, P., Afonso, A., Jacinto, G., Saias, J., Nogueira, V. (2020). Modelação e predição de acidentes de

viação no distrito de Setúbal (MOPREVIS): O papel dos SIG na construção de uma base de dados e na análise espacial. Jornadas do ICT 2020, 13 e 14 de fevereiro, Braga. *Livro de resumos*, 46.

- **B34.** Carinhas, D., **Infante, P**., Martinho, A., Vasquez, F. (2020). Comparação de dados maregráficos em tempo quase-real. 6as. Jornadas de Engenharia Hidrográfica/1.as Jornadas Luso-Espanholas de Hidrografia, 3-5 Novembro, Lisboa (online).
- **B35.** Carinhas, D., **Infante, P**., Martinho, A. (2020). Prediction of tides using data in near-real time. XXVII Meeting of the Portuguese Association of Classification and Data Analysis, 22 24 October, Lisboa (online).

Invited communications at national events

B36. Days in Logic 2020, University of Lisbon, <u>http://dil2020.campus.ciencias.ulisboa.pt/node/10</u>, Imme van den Berg, Foundational aspects of external numbers, <u>Booklet.pdf (ulisboa.pt)</u>, p.7.

C – Reports

- **C1** . Alan Champneys, Andrew Lacey, Hilary Ockendon, John Ockendon, Nico Marrin, Karin Mora, Matthew Moore, Geo Walker, Matthew Shirley, Yahya Farah, Alexander Shaw, Bernard Piette, James Roscoe, **Joaquim Correia**, Dhanesh Patel, Gopal Gaijar, Mat Hunt, 162nd ESGI, 20--24 July 2020, University of Leeds, Leeds (online), UK, Communication-answer to the Problem presented by Faraday Predictive: *Understanding the Fundamentals of Motor Current Signature Analysis*, <u>https://conferences.leeds.ac.uk/lesgi/</u>
- C2 .João A. Sousa, is co-author of the M27 Report of the EURAMET 17NRM05-EMUE project. "Good practice in evaluating measurement uncertainty. Compendium of examples". Adriaan M. H. van der Veen and Maurice Cox (editors). 1st edition, November 12, 2020.
- C3 S. Demeyer, N. Fischer, M.G. Cox, A.M.H. van der Veen, J.A. Sousa, O. Pellegrino, A. Bosnjakovic, C. Elster Bayesian approach applied to the mass calibration. In "Good practice in evaluating measurement uncertainty. Compendium of examples". Eds. A. van der Veen, M. G. Cox. EMPIR Project 17NMR05 "EMUE Examples of Measurement Uncertainty Evaluation", 1st Ed. (M27), 12 Nov. 2020. pp. 27-32.
- C4 L.L. Martins, A.S. Ribeiro, M.G. Cox, J.A. Sousa, D. Loureiro, M.C. Almeida, M.A. Silva, R. Brito, A.C. Soares - Evaluation of measurement uncertainty in SBI – Single Burning Item reaction to fire test. In "Good practice in evaluating measurement uncertainty. Compendium of examples". Eds. A. van der Veen, M. G. Cox. EMPIR Project 17NMR05

"EMUE – Examples of Measurement Uncertainty Evaluation", 1st Ed. (M27), 12 Nov. 2020. pp. 33-46.

- C5 L.L. Martins, A.S. Ribeiro, M.G. Cox, J.A. Sousa, D. Loureiro, M.C. Almeida, M.A. Silva, R. Brito, A.C. Soares Evaluation of measurement uncertainty in the calibration of a mobile optical measurement system. In "Good practice in evaluating measurement uncertainty. Compendium of examples". Eds. A. van der Veen, M. G. Cox. EMPIR Project 17NMR05 "EMUE Examples of Measurement Uncertainty Evaluation", 1st Ed. (M27), 12 Nov. 2020. pp. 153-158.
- C6 J.A. Sousa, A.S. Ribeiro, M.G. Cox, L.L. Martins Evaluation of measurement uncertainty in thermal comfort. In "Good practice in evaluating measurement uncertainty. Compendium of examples". Eds. A. van der Veen, M. G. Cox. EMPIR Project 17NMR05 "EMUE – Examples of Measurement Uncertainty Evaluation", 1st Ed. (M27), 12 Nov. 2020. pp. 159-170.

D – Organization of conferences and seminars

International Meetings

- **D1. Robert de Sousa**, <u>The Cape Verde International Days on Mathematics 2020 -</u> <u>CVIM'2020</u>, Canceled because SARS-COV-2, Organizer Member
- D2. Marília Pires, Conferência Internacional European Conference on Numerical Mathematics and Advanced Applications (ENUMATH), 20 - 24 de Setembro de 2021, IST-UTL, Lisboa, Portugal, Organizer Member, <u>http://enumath2021.com/</u>
- D3. Joaquim Correia, Complex Singularities and Regularisations of Conservation Laws, Research-in-Groups, ICMS, Edinburgh, UK, November 30–December 11, 2020 (postponed to 2021), Organizer Member, <u>https://www.icms.org.uk/funding-opportunities/research-groups-rigs</u>
- D4. Maurício Reis, 34th AAAI Conference on Artificial Intelligence (AAAI-20), New York, New York, USA, February 7–12, 2020, <u>https://aaai.org/Conferences/AAAI-20/</u>, Program Committee member.
- D5. Maurício Reis, 29th International Joint Conference on Artificial Intelligence and 17th Pacific Rim International Conference on Artificial Intelligence (IJCAI-PRICAI2020), Yokohama, Japan, January 7-15, 2021,<u>https://ijcai20.org/</u>, Program Committee member.
- D6. José Carmo, 15th International Conference on Deontic Logic and Normative Systems (DEON 2020/21), (prevista para 30th july - 2nd August 2020 e adiada para 21-24 July 2021, devido `pandemia do COVID), Munich Center for Mathematical Philosophy (MCMP/LMU), Munich, Germany, member of the Program Committee.

- **D7.** Membro da comissão organizadora da "2nd International Conference on Mathematical Applications 19", Ponta Delgada, 8 -11 de julho de 2019, https://iknowd.org/icma19/committees (J. Cabral)
- D8. Chairman da "2nd International Conference on Mathematical Applications 19", Ponta Delgada, 8 -11 de julho de 2019, https://iknowd.org/wp-content/uploads/submissions/icma1919/icma1919_4_IKnowD_20191103162745.pdf, pág. v. http://jcabral.uac.pt/ICMA2019chairman.pdf (J. Cabral)
- **D9.** Membro da comissão organizadora da "3rd International Conference in Engineering Applications 2019", Ponta Delgada, 8 -11 de julho de 2019, https://iknowd.org/icea 19/committees (J. Cabral)
- D10. Carlos A. Braumann. DSABNS 2020, 11th Conference on Dynamical Systems Applied to Biology and Natural Sciences, 4-7 February 2020, Trento, Italy, <u>http://www.dsabns2020.maths.unitn.it/index.html</u>. International Organizing Committee member: http://www.dsabns2020.maths.unitn.it/organ.html
- D11. Carlos A. Braumann. VII Workshop on Computational Data Analysis and Numerical Methods, 10-12 September 2020, ONLINE hosted by Instituto Politécnico de Tomar, <u>http://www.wcdanm.ipt.pt/</u>. Scientific Committee member: <u>http://www.wcdanm.ipt.pt/pt/committees/</u>
- D12. Carlos A. Braumann. DSABNS 2021 Virtual, 12th Conference on Dynamical Systems Applied to Biology and Natural Sciences DSABNS 2021, 2-5 February 2021, virtual, hosted by the Basque Centre for Applied Mathematics, Bilbao, Spain, <u>https://wp.bcamath.org/dsabns21/</u>. International Organizing Committee member: <u>https://wp.bcamath.org/dsabns21/?page_id=13</u>
- D13. José M. Carmo, 15th International Conference on Deontic Logic and Normative Systems (DEON 2020/21), 30th july - 2nd August 202, <u>https://www.mcmp.philosophie.uni-</u> <u>muenchen.de/events/workshops/container/deon-2021/index.html</u>, member of the Program Committee.
- D14. Ludwig Streit, co-organizer. 9th Jagna International Workshop: Stochastic Analysis –Mathematical Methods and Real World Models. January 8 – 18. Research Center for Theoretical Physics ,Central Visayan Institute Foundation Jagna, Bohol6308, Philippines. https://spp-online.org/jagna2020/
- **D15.** Ludwig Streit. Academia das Ciências de Lisboa workshop "Dialogues in Infinite Dimensional Analysis"29. Setembro a 2 de Outubro de 2020., coorganizer. <u>http://www.acad-ciencias.pt/agenda/evento/655</u>
- D16. Paulo Infante & Anabela Afonso, XXVII Meeting of the Portuguese Association of Classification and Data Analysis, Lisboa, 22 - 24 October (online), Scientific Committee:

http://www.joclad.ipt.pt/joclad2020/en/joclad2020/organizacao

- **D17. Manuela Oliveira**, Sessão "Statistical application: price modeling, COVID-19 and artificial intelligence" no VII Workshop on Computational Data Analysis and Numerical Methods (VII WCDANM). Tomar, Portugal. September 10-12 September, <u>http://www.wcdanm.ipt.pt/</u>
- **D18. Manuela Oliveira**, VI Workshop on Computational Data Analysis and Numerical Methods (VI WCDANM). Covilhã, Portugal. June 27-29, 2019, Scientific Committee: <u>http://www.wcdanm-ubi19.uevora.pt/</u>

National Meetings

D19. Fernando Carapau, VII Workshop on Computational Data Analysis and Numerical Methods, 10-12 September de 2020, Instituto Politécnico de Tomar, Tomar, Portugal (Online Conference)

Organizer Member, http://www.wcdanm.ipt.pt/pt/home/

- D20. Joaquim Correia, PDEs in Biomathematics, ENSPM 2020, Sessão Temática, Inst. Polit. Tomar, Tomar, Portugal, 13–15 julho, 2020 (postponed to 2021), Organizer Member, <u>http://www.enspm20.ipt.pt/</u>
- **D21.** Pedro Marques- Member of the organising committee of the Workshop "Construindo Aprendizagem", University of Évora, 24th March (postponed due to Covid19 restrictions) <u>http://www.workshop-construindo-aprendizagem.uevora.pt/</u>
- **D22.** Co-responsável pela organização da conferência RECPAD2020 Conferência Portuguesa de Reconhecimento de Padrões, Évora, 2020. (Luís Rato).

E – Advanced training

PhD Thesis (Concluded)

- **E1** Marco Henrique Vieira Marto, Innovating Forest Ecosystem Management with Advanced Multi-criteria Decision-Making Methods, Advisor: J. Borges, V. Bushenkov, S. Marques, ISA, UL, Dezembro de 2020
- **E2** Rui Manuel Silva Carapinha, Nonlinear and Functional Higher Order Impulsive Problems, under the PhD Program in Mathematics at the University of Évora, **Feliz Minhós** Adviser.

- E3 ShibSankar Bowmick, "Multi-Omics Data Analysis using Machine Learning for Cancer Prediction and Diagnosis", Ph.D. degree of Jadavpur University, (co-orientação Debotosh Bhattacharjee, e Luís Rato), Novembro de 2020.
- E4 Sílvia Madeira, Hazard Models Applied to Industrial Equipment Using Reliability Distributions and RCM Implementation, Infante, P., Didlet, F.
- E5 Domingos Silva, Estatística de Extremos: Limites da Performance Humana estudo com lançadores e saltadores do atletismo, Caeiro, F., **Oliveira, M.**

Master Thesis (Concluded)

- E6 Nelson Fernandes: Classic Fractions: Application to the classroom in S. Tomé, University of Évora, November 2020, Fernando Carapau Advisor
- E7 Rui Ricardo Almeida Vieira, Extração de dados de direção do vento a partir de radar HF, Joaquim Amândio Azevedo.
- E8 David Miguel Abegão Inácio, Sistema de transmissão de áudio digital, Joaquim Amândio Azevedo.
- E9 Nuno Freitas Pereira, Recolha de dados numa rede de sensores em ambiente urbano, Joaquim Amândio Azevedo.
- E10 Rodrigo Silva (2020). *Hábitos de sono e de atividade física e desportiva das crianças do 1º ciclo do ensino básico de Évora*. Mestrado em Modelação Estatística e Análise de Dados, Universidade de Évora. **Afonso, A., Infante, P.** e **Jacinto, G.**.
- E11 Fernando Moreno. "Estudo comparativo de métodos de análise e previsão de séries temporais: métodos estatísticos versus redes neuronais". Curso de mestrado em Modelação Estatística e Análise de Dados da Universidade de Évora. Orientação: Dulce Gomes.

Curricular and Scientific Internships:

- E12 Orlando Albertino Couve, Matemática Aplicada à Mecânica dos Fluidos e suas Aplicações, Estágios Científicos Avançados em Matemática-PALOP, Fundação Calouste Gulbenkian, Orientação, **F. Carapau, P. Correia.**
- E13 Diogo Costa, Bachelor monograph, "Graph Theory and Matrix Analysis Applications: Google's PageRank", University of Évora, Bachelor in Applied

Mathematics for Economics and Management, 16th July 2020, supervisor: Pedro Macias Marques.

- E14 Fábio Tolentino Henriques Pita, bolsa de investigação, Plataforma de monitorização de riscos ambientais, Joaquim Amândio Azevedo.
- E15 João André Santos Brás, bolsa de investigação, Deteção automática do nível de caudal a partir de imagens, Joaquim Amândio Azevedo

PhD Thesis (ongoing)

- E16 K. Vongsavang, *Diffusive-Dispersive Conservation Laws in Coagulation-Fragmentation,* (Adviser Joaquim Correia, F.P. da Costa, Universidade Aberta, Portugal)
- **E17** B. Doungsavanh, *Mathematical Analysis of Structured Models of Waterborne Diseases: Application to Laos,* (Adviser **Joaquim Correia**, Y. Mammeri, Université de Picardie Jules Verne, France)
- **E18** [3] G. Maypaokha, *The Effect of Saturating Diffusion on Hyperbolic Partial Dierential Equations,* (Adviser **Joaquim Correia**, N. Bedjaoui, Université de Picardie Jules Verne, France).
- **E19** Infeliz Carvalho Coxe, Lower and upper solutions method on higher order boundary value problems including differential equations and coupled systems, University of Malange, Angola, under the PhD Program in Mathematics at the University of Évora, **Feliz Minhós** Adviser
- **E20** Nelson Pires dos Santos Neto Fernandes. Theme related to an open mathematical subject associated with one-dimensional models obtained via Cosserat theory for incompressible Newtonian and non-Newtonian fluids, for the problem of fluid-structure interaction with fluid flow in rectilinear tubes of circular section. And, still, models for the flow of a non-Newtonian fluid in curved tubes of circular section (Newtonian case solved), **Fernando Carapau** Adviser
- **E21** João Horta, Universidade de Cabo Verde, Propriedades algébricas dos números externos, Universidade de Évora, Supervisor Imme van den Berg.
- **E22** Immad Berrabah, Slow-fast fields with external numbers, Université de M'Sila, Argelia, supervisor Abdelmadjid Boudaoud, co-supervisor Imme van den Berg.
- **E23** M. C.Faria, Positioned numerical semigroups, registered in Universidade Nova de Lisboa (co-supervisor Manuel Branco with com J. C. Rosales e M. Messias),
- **E24** Márcio André Traesel, Numerical semigroups, registered in Universidade de Évora (co-supervisor Manuel Branco with com J. C. Rosales)

- E25 Kashyap Damjibhai Raiyani, em co-orientação "Multi-Layer Fusion Model for Agricultural Land Cover and Usage Dynamics Mapping", Doutoramento em Informática, Universidade de Évora. (Luís Rato)
- E26 Nada El Bouziani, Doutoramento em Mecatrónica. Universidade de Évora. (coorientação C. Ramos, M. Tlençani)
- E27 Sara Perestrelo, "Processos epidémicos em redes complexas: modelação e simulação. Aplicação ao caso de incêndios florestais"(co-orientação C. Grácio, Nuno Ribeiro).
- **E28** Ivo Miguel Sousa Ferreira, Modelos de Sobrevivência Paramétricos para Acontecimentos Múltiplos, 2019, Ana Maria Abreu, C.S. Rocha.
- E29 Manuel Alberto, Sinistralidade rodoviária em Angola: Uma análise em Séries temporais, 2016, Dulce Gomes and Patrícia A. Filipe
- E30 Jaime Agostinho Jerónimo, Análise de sobrevivência de mulheres diagnosticadas com cancro de mama em Angola no período de 2013 a 2017, 2018, Patrícia A. Filipe and Dulce Gomes
- E31 Nelson Tchingui Jamba, Modelos mistos de crescimento individual em ambiente aleatório, 2018, **Patrícia A. Filipe** and **Gonçalo Jacinto.**
- E32 Luísa Carvalho, Métodos de Amostragem em Cartas de Controlo por Atributos, Doutoramento em Matemática, Universidade de Évora. Infante, P., Afonso, A.
- E33 Maria João Inácio, Cartas de Controlo: Monitorização de Perfis e Risco Ajustado, Doutoramento em Matemática, Universidade de Évora. Infante.
 P., Figueiredo, F. O.
- E34 Dora Carinhas, Modelação Estatística das Marés, Doutoramento em Matemática, Universidade de Évora. Infante, P., Martinho, A.
- E35 Marisa Loureiro. "Modelos estatísticos temporais e espaciais aplicados à análise da conetividade efetiva em dados de ressonância magnética funcional (fMRI)". Programa de doutoramento em Matemática da Universidade de Évora. Supervisors: Dulce Gomes, Bruno de Sousa (Faculdade de Psicologia e Ciências da Educação da Universidade de Coimbra) e Miguel Castelo Branco (Faculdade de Medicina da Universidade de Coimbra)
- E36 Thaís Zamboni Berra. "O impacto do GeneXpert® MTB/RIF na detecção da Tuberculose e da Tuberculose multidroga-resistente e seu padrão espacial em

Ribeirão Preto-SP[°]. Doutoramento de Enfermagem em Saúde Pública, Escola de Enfermagem de Ribeirão Preto da Universidade de São Paulo, Brasil. Supervisors: Ricardo Alexandre Arcêncio e **Dulce Gomes**

E37 Armando Alexandre Coholina. "Família de Modelos Aditivos". Doutoramento em Matemática, Universidade de Évora. Supervisors: **Manuela Oliveira** e João Mexia.

Master Thesis (ongoing)

- E38 Anilzabel Ramos: One-dimensional Models for Newtonian and Generalized Newtonian Fluids, University of Évora, Fernando Carapau Advisor, January 2021
- E39 Atanásio Barros Rodrigues Bandeira, Sistemas de equações diferenciais não lineares de 1ª ordem e aplicações, University of S. Tomé e Príncipe, Feliz Minhós Adviser
- **E40** Fernando Jorge Barradas Corvelo, "Ferramenta de monitorização e gestão de listas de espera no Hospital de Évora". (Adviser : Luis Rato)
- **E41** Ricardo Jorge Chambel Benedito, "Software development of SmartShiP A smart shift planning tool". (Adviser : Luis Rato)
- **E42** Sharmin Sultana Prite, "Detecção de Risco de desistência na Universidade de Évora". (Adviser : Luis Rato)
- **E43** André Salgado Cândido, "Uma plataforma para suporte à aprendizagem em Instituições de Ensino Superior". (Adviser : Luis Rato)
- E44 Pedro Daniel Ponte Camacho, Um novo pacote no R para visualizar dados em Análise de Sobrevivência, **Ana Maria Abreu**.
- E45 Susana Maria Pereira da Silva, Análise de Sobrevivência aplicada à Educação, Ana Maria Abreu.
- E46 Francisco Carlos Ramos de Carvalho, "O insucesso no ensino da disciplina de Matemática no 2º ciclo do secundário em São Tomé e Príncipe." Mestrado em Matemática e Aplicações, Universidade de Évora. Supervisors: Dulce Gomes and Patrícia A. Filipe
- E47 Ana Paula Ferrari Januário, Análise estatística da produção de vitelão Mertolengo, Patrícia A. Filipe and Gonçalo Jacinto
- E48 Ana Sapata. Uso de modelos de regressão e de machine learning para modelação dos resultados de jogos de futebol. Mestrado em Modelação Estatística e Análise de Dados, Universidade de Évora. Afonso, A., Saias, J..

- **E49** João Paulo Alter. *Volatility Forecast for the Brazilian Stock Market (Bovespa Index)*. Mestrado em Modelação Estatística e Análise de Dados, Universidade de Évora. **Afonso, A.**, Minhoto, M., Moutinho, V. M. F.
- E50 Loide Ascenso. Modelação Estatística da Afluência ao Serviço de Urgência do HESE. Mestrado em Modelação Estatística e Análise de Dados, Universidade de Évora. Jacinto, G., Infante, P.
- E51 Taymara Rodrigues. "Mortalidade por causas relacionadas a aids em amazônidas e seus determinantes sociais: análise espacial e temporal". Curso de mestrado em Enfermagem, Instituto de Ciências da Saúde da Universidade Federal do Pará (Brasil). Supervisors: Eliã Botelho (ICS-UP) e Dulce Gomes.

H – Invited talks and seminars

- H1 Feliz Minhós, Coupled systems of Hammerstein-type integral equations with signchanging kernels on bounded and unbounded intervals, Seminar in the Department of Mathematics of University of Aveiro, at 12th February, 2020, invited by the group of Functional Analysis and Applications (GAFA) of the research center CIDMA
- **H2 Joaquim Correia**, Lecture *Examples of Discretization of Partial Differential Equations*, SEAMS (South East Asia Mathematical Society) 2020 School, Modern Tools for Mathematical Modeling of Ecosystems, Caraga State University, Butuan City, Philippines, August 19–28, 2020, postponed to 2021 https://sites.google.com/view/seamsph2020
- H3 Marília Pires, An alternative stabilization method of numerical simulations of Oldroyd-B type fluids, Seminário de Análise Numérica e Matemática Aplicada, Seminário online do Instituto Superior Técnico, Julho 30, 2020 https://math.tecnico.ulisboa.pt/seminars/numerica/?action=show\&id=5856
- H4 Imme van den Berg, A nonstandard model for linear systems with uncertainties, Seminário de Lógica Matemática XXXII, 8, CMAFcIO, FCUL-IST Lisboa, 30-11-2020, <u>https://ciencias.ulisboa.pt/pt/evento/30-11-2020/a-nonstandard-model-for-linearsystems-with-uncertainties</u>

I. Projects and scientific contracts

FCT Projects

- I1 V. Bushenkov, POCI-01-0145-FEDER-030391 Forest ecosystem management decision making methods: an integrated bioeconomic approach to sustainability (BIOECOSYS), Início: 19/08/2018 Termo: 31/01/2022, Responsible for the team at the University of Évora.
- I2 V. Bushenkov, PCIF/MOS/0217/2017 A multiple criteria approach to integrate wildfire behavior in forest management planning (MODFIRE), Início: 19/03/2019 Termo: 18/03/2022, Responsible for the team at the University of Évora.
- I3 Fernando Carapau, Collaborating member of the Centro de Matemática Computacional e Estocástica (CE/MAT/IST), Projecto UID/Multi/04621/2013, 2020. Affectaed to the research group/line Mathematical Modeling in Biomedicine (MMB).
- I4 Marília Pires, Collaborating member of the Centro de Matemática Computacional e Estocástica (CE/MAT/IST), Projecto UID/Multi/04621/2013, 2020. Affectaed to the research group/line Mathematical Modeling in Biomedicine (MMB)
- I5 Project PTDC/CCI-COM/30990/2017, "Revisão de Crenças aplicada a Terapias de Neurorehabilitação"/"Belief Revision applied to Neurorehabilitation Therapy". Execution Period: from 01-10-2018 to 30-09-2021. Principal Investigator: Prof. Dr. Eduardo Fermé. Total Funding: 238.396,31€.
- I6 LTHE Aprender e Ensinar na Universidade, Candidatura:26/05/2017 Termo: 14/07/2021 Tipo: Investigação FCT / ALT20-03-0145-FEDER-029252, FCT. (Luis Rato)
- I7 BRO-CQ Controlo de Qualidade de Blocos em Rochas Ornamentais, ALT20-03-0247-FEDER-017659 prorrogado até 30/04/2021, PI, M. Tlemçani. (C Ramos, L. Bandeira, S. Fernandes)
- I8 AdaptAlentejo Predicting ecosystem-level responses to climate change, inicio: 01/03/2019, termo:28/02/2022, PI Miguel Matias, POCI-01-0145-FEDER-030793, (C. Ramos)
- **19** CILIFO. Centro Ibérico de Investigação e Combate aos Incêndios Florestais", financiado pelo programa EP -- INTERREG V A España Portugal (POCTEP) (C. Gracio)

International projects

- **I10 V. Bushenkov**, N3435, Horizon2020, Comissão Europea Models and decision SUpport tools for integrated Forest policy development under global change and associated Risk and Uncertainty (SuFoRun), Início: 01/02/2016 Termo: 31/01/2020, Team member
- I11 NANOSens AQM Desenvolvimento e validação no terreno de um sistema de nanosensores de baixo consumo e baixo custo para a monitorização em tempo real da qualidade do ar ambiente; Candidatura: 21/03/2017 Termo: 31/03/2021; Interreg / SOE2/P1/E0569. (Luis Rato)

Bilateral Projects

I12 Joaquim Correia, PICS 2018 n.o 8262 (UÉvora Projeto n.o 4126), French-Portuguese Project CNRS/FCT Diffusive-Dispersive Limit of Hyperbolic Conservation Laws, 2019– 2021

Contracts with Industry

- I13 NIIA Núcleo de investigação em inteligência artificial em agricultura (29/09/2017 -01/07/2021 ALT20-03-0247-FEDER-036981) Co-promoção/empresa líder: Agroinsider Sistemas e Paralelismo, Portugal 2020. (Luis Rato)
- **114** MORA-Collection "The Mora Sample Collection Project" parceria Laboratório HERCULES e ICCROM-Center for the Study Preservation and Restoration of Cultural Property, Rome, 2018-2020. (Luis Rato)
- **115** Audit-F. Audit Furnace, Candidatura: 14/03/2016 Termo: 31/07/2020, Tipo: Investigação ALT20-03-0247-FEDER-017980, Portugal 2020. (Luis Rato)

Summary of CIMA 2020 indicators

A.1. Books	Books	3
	Chapters	5
A.2. Papers	Internationals	56
	Nationals	4
A.3. Proceedings	Internationals	14
	Nationals	4
A.4. Special Issues Edited		4
Total Publications		90
B. Comunications	Internationals	28
	Nationals	8
Total Comunications		36
C. Reports		6
D. Organization of events	Internationals	18
	Nationals	4
E. Advanced Training	PhDs	27
	Masters	20
	Others	4
H – Invited Seminars		7
I - Projects		21