



Scientific Report 2012

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Name of the Research Unit	(MAT-LVT-297) Centro de Matemática e Aplicações – CMA
Coordinator	Maria Luísa Martins Macedo de Faria Mascarenhas
Main Scientific Domain	Mathematics

Leading Host Institution: Faculdade de Ciências e Tecnologia – Universidade Nova de Lisboa.

1. Objectives & Achievements

1.1. Unit Description

CMA/FCT/UNL is located at Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa (FCT/UNL) at Caparica Campus and occupies two large rooms on the first floor of building VII, where is also located the Department of Mathematics (DM).

CMA/UNL has 55 Ph.D. active researchers and 38 collaborators, including Ph.D. and M.Sc. students, internal collaborators and collaborators integrated in other research units. The scientists at the center are organized into four research groups (see Figure 1):

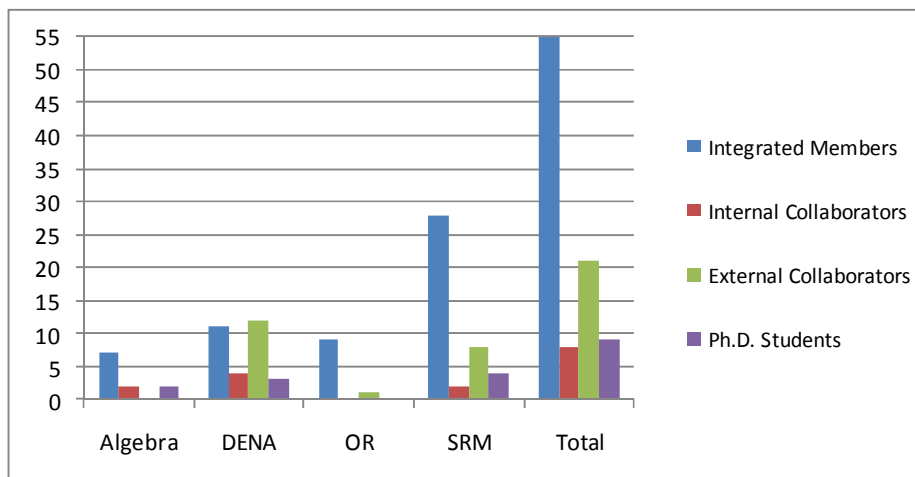


Figure 1 – CMA internal structure.

- Algebra (A)
- Differential Equations and Numerical Analysis (DENA)
- Operations Research (OR)
- Statistics and Risk Management (SRM)

The Coordinator provides leadership and guidance for the development and implementation of research orientation in accordance with the decisions of the Scientific Committee (composed by all the active Ph.D. members) and is assisted by an Executive Committee composed by four members. An External Permanent Advising Scientific Committee composed by five internationally recognized high-level researchers, follows the scientific activities of the center. The secretariat of the Department of Mathematics supervises accounting and general administrative support is provided by a BGCT grant.

CMA bylaw and membership requirement regulations are available in a written document, reviewed every year in order to contemplate the classification of the researchers according to productivity indicators. Funding is allocated to each team, proportionally to the corresponding number of Ph.D. active researchers.

For more information please visit the CMA/FCT/UNL web site:

<http://www.cma.fct.unl.pt>

1. 2. General Objectives

The objective of CMA/FCT/UNL is to continue to promote high-level scientific research in the areas of pure and applied mathematics and its subsequent national and international projection.

Together with the strong support provided to traditional areas in the unit, like Actuarial Science, Financial Mathematics and Statistics (team Statistics and Risk Management) and Combinatorial and Nonlinear Optimization (team Operations Research), more abstract areas are to be developed within the team Algebra, like Combinatorial Number Theory, Linear Algebra and Matrix Theory, Non-commutative Algebraic Geometry, Ockham Algebras, Semigroups, Combinatorics and Graph Theory, Discrete Geometry and Algebraic and Differential Geometrical Methods for Topological Quantum Field Theories. We have also widened the scope of our applications concerning Differential Equations and Numerical Analysis: research has been oriented to Biomathematics, Material Science and Fluid Mechanics.

An effective interaction with high level international research centers and universities, like MIT, CMU, Univ. Texas-Austin, École Polytechnique Fédérale de Lausanne

(EPFL), has been successfully promoted through direct collaboration and/or the approval of several international research projects.

Also the internal interaction among the research teams is steadily increasing, always preserving their own scientific strategy. Collaboration between Operations Research and Differential Equations and Numerical Analysis already exists through optimization problems and numerical methods. Collaboration between the groups Statistics and Risk Management and Differential Equations and Numerical Analysis is leading to some issues in Financial Mathematics. To reinforce this direction and to extend it to other disciplines inside and outside the FCT/UNL, weekly seminars are organized by the different research teams.

CMA/FCT/UNL collaborates with the Ph.D. and Post Doc Programs in Applied Mathematics, in the scope of CoLab University of Texas at Austin-Portugal and ICTI Carnegie Mellon University-Portugal.

CMA/FCT/UNL supports regular outreach activities promoted by its members such as:

- MatNova 2012, a September Summer School, specifically directed to high school students, is an event that we intend to renew every year.

The center partially sponsors the event, aiming to increase the number of scholarships for young researchers in future FCT/MEC calls.



- ClubeMath, directed to basic and high school students, which aims to show a different facet of Mathematics, through fun and recreational activities, in order to stimulate skills and interest in this science.

CMA/FCT/UNL also supports several scientific national and international events, organized with the collaboration of its members.

Despite the enormous teaching charge, our researchers generally honor their commitments and develop an interesting scientific work.

In order to encourage good research practices and create adequate working conditions, we mention two goals:

- Promote, whenever it is possible, the reduction of the teaching charge for active researchers with outstanding scientific projects;
- Recover the scientific activity, through work plans, of investigators that have not met the productivity indicators referred in the unit description above.

1. 3. Main Achievements During the Year of 2012

The main achievement of the research unit was the consolidation of its international projection, by the increment in the quality of its scientific production, by the impact of its research in institutions like MIT, CMU or EPFL, where some of its members were invited to lecture.

We list some highlights:

- Fabio Chalub was selected as "Investigador FCT" and, consequently, will have the possibility to dedicate 100% of the time to research during 5 years. This award is funded by the Portuguese Science and Technology Foundation. He works in the interface between mathematics and biology.
- Oleksiy Karlovych joined the group, starting in January 2013. He works in operator theory and functional analysis, with more than 30 publications.
- Rogério Martins was selected as "top 100 people that impact Portugal" for the year 2012 by Expresso:
(http://www.cma.fct.unl.pt/sites/www.cma.fct.unl.pt/files/Not%C3%ADcias/Imagens/influentes_RM.jpg) a general news weekly newspaper. This follows his weekly TV show about mathematics and his position as director of "Gazeta de Matemática", a non-profit publication of the Sociedade Portuguesa de Matemática.
- Starting in September/October 2013 a new post-doc, Xin Yang Lu, currently at Carnegie Mellon University (CMU), will join the group. Possible collaborators are Luísa Mascarenhas and Ana Margarida Ribeiro. He will be funded by the international partnership between portuguese universities and CMU.

The unit attracted new members, new collaborators and increased, significantly, its funds.

The following events, organized or co-organized by CMA/FCT/UNL members, were partially funded by CMA/FCT/UNL:

- ClubeMath 2012, FCT/UNL.
- Joint Meeting of y-BIS-Young Business and Industrial Statisticians of the International Society for Business and Industrial Statisticians and jSPE-Young Statisticians of the Portuguese Statistical Society, Caparica, Portugal, 23-26 July 2012.
- Summer School MatNova 2012, FCT/UNL, 4-8 September 2012.

The specific scientific accomplishments during the year 2012 are detailed in the Research Groups report.

The overall scientific production of the teams can be found in Table 1:

Teams	ISI Journals		Other International Publications	PI projects	Ph.D. Completed	M.Sc. Completed
	Published	Accepted				
Algebra	10	2	4	1	0	0
DENA	7	4	5	3	1	0
OR	8	0	7	0	1	1
SRM	23	11	29	0	3	2
Total	48	17	45	4	5	3

Table 1 – Overall scientific production.

This shows an average of approximately 1.70 international publications and 0.87 in ISI journals (where accepted papers were not included), per researcher per year. Figures 2 and 3 represent a graphical comparison between the number of publications and projects, respectively, in the years 2010, 2011 and 2012.

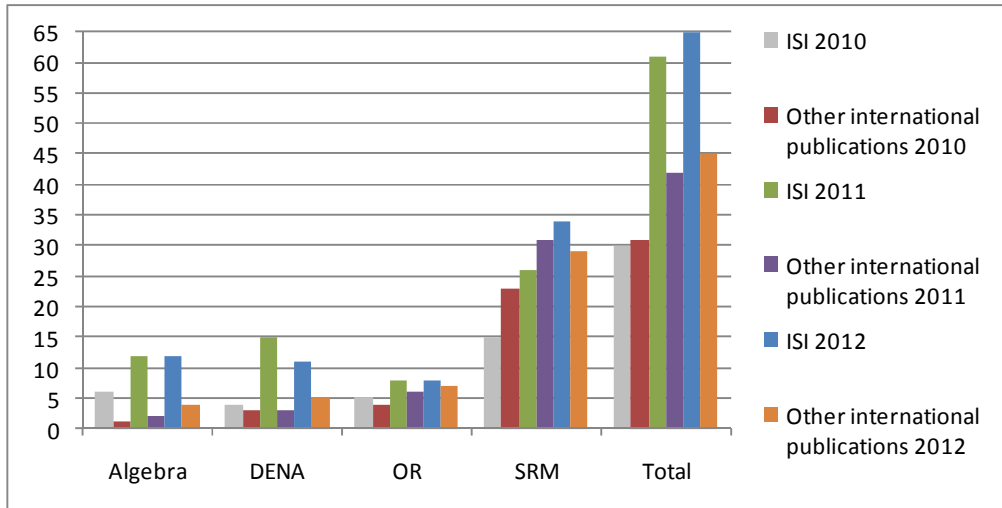


Figure 2 – Comparison between number of journal publications by CMA members, in the years 2010, 2011 and 2012.

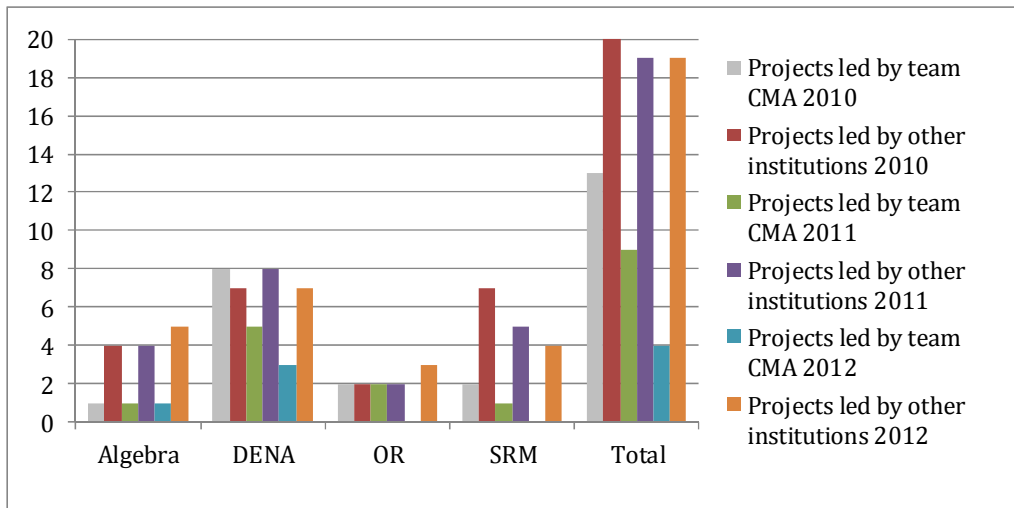


Figure 3 – Number of projects lead by CMA members and projects lead by other institutions in the years 2010, 2011 and 2012.

2. Activities

2.1. Integrative/Multidisciplinary Activities During the Year of 2012

All research groups organize weekly seminars allowing interaction with other disciplines inside and outside FCT/UNL.

Through the different research projects there were significant interactions with researchers from Mathematical Economy, Medical Schools, Agronomy and Computer Science.

Several members among the researchers, collaborators, Ph.D. and M.Sc. students, especially in team SRM and OR, develop their professional activities in connection with the industry (energy, banking, insurance, networks) allowing very useful interactions.

Some members of the team DENA work in Biomathematics, others in Epidemiology problems, in collaboration with the Gulbenkian Institute of Science. Members of DENA address also problems from Fluid Mechanics, mathematical problems in Material Science, Image Reconstruction or Games Theory.

The activities mentioned above are linked with the scientific projects and with the organization/participation in international meetings, described in the items Research Groups.

Our members have scientific collaborations with the main Research Centers in Portugal and with several high level foreign Universities and Research Centers.

We consolidate our participation in the Ph.D. and Post Doc Programs in Applied Mathematics, in the scope of CoLab University of Texas at Austin-Portugal and ICTI Carnegie Mellon University-Portugal.

2.2. Outreach Activities During the Year of 2012

CMA/FCT/UNL is member of the Associação Portuguesa de Investigação Operacional (APDIO) and of the Comissão Nacional de Matemática (CNM). Collaborates with the Centro Internacional de Matemática (CIM) and with the Sociedade Portuguesa de Matemática (SPM).

Manuel Silva:

Leads a math school for students from 7-9th grade <http://aleph.ptmat.fc.ul.pt>.

Taught a course on "Problem solving" for high school teachers.

4 papers on *Gazeta de Matemática*:

- *Gazeta 166: A geometria segundo Paul Erdos*, Pedro J. Freitas and Manuel Silva;
- *Gazeta 167: Um problema de matrizes com favos de mel*, Pedro J. Freitas and Manuel Silva;
- *Gazeta 168: Um problema para polimatemáticos*, Pedro J. Freitas and Manuel Silva;
- *Gazeta 169: O donut perfeito*, Pedro J. Freitas and Manuel Silva.

Among our members we count:

- The director of "*Gazeta de Matemática*" (a scientific diffusion non-profit publication by the SPM).
- The president of the audit committee of the SPM.
- A member of the Education Committee of the Portuguese Institute of Actuaries.
- A co-founder of the Section of Young Statisticians, of the Portuguese Statistical Society (SPE).

Members of almost all the research groups collaborated in the following projects, all promoted by CMA/FCT/UNL members, exception made for the last two items. Those projects involve scientific divulgation or special training in mathematics, addressed to young students from schools:

- ClubeMath (<http://eventos.fct.unl.pt/clubemath>)
- Conferences "Implica Matemática" (<http://eventos.fct.unl.pt/implica-matematica>)
- DivMAT (<https://sites.google.com/site/divmatfct/home/o-grupo-divmat>)
- ESCOLA ALEPH (<http://aleph.ptmat.fc.ul.pt>)

- ExpoFCT (<http://www.fct.unl.pt/galerias/expo-fct-2012>)
- PREPARA-ME (project of the DM/FCT/UNL in Mathematics, directed to students from engineering)
- Summer School MatNova 2012 (<http://eventos.fct.unl.pt/matnova2012>)

Several members of the center contributed individually to other outreach activities through:

- Participation in several TV programs, for example, "Isto é Matemática", SIC-Notícias.
- Scientific diffusion in high schools.
- Several lectures organized by SPM.

3. Funding

	2008	2009	2010	2011	2012 (*)
LA FCT	0,00	0,00	0,00	0,00	
Units FCT	68.922,49	187.687,50	131.381,25	202.290,05	
Projects FCT	34.200,00	46.337,60	50.773,60	70.786,02	
Other (National)	0,00	200,00	0,00	0,00	
Other (International)	0,00	0,00	0,00	0,00	
National Industry	0,00	0,00	0,00	0,00	
International Industry	0,00	0,00	0,00	0,00	
Total	103.122,49	234.225,10	182.154,85	273.076,07	

(*) – Funding during 2012 was more or less the same as in 2011, however we still do not have the exact information.

4. General Indicators

	2007	2008	2009	2010	2011	2012	Total
No. of Researchers Hired (Ciência Programme)	0	4	2	0	0	0	6
No. of Researchers integrated with Ph.D.	42	49	48	49	49	55	---
Training Ph.Ds. (Ph.D. theses completed)	12	9	7	1	1	5	30

5. Technical Personnel Hired

Name	Start date	End Date
Vanda Sofia dos Santos Martins	01-04-2011	30-12-2013

6. Research Groups

Reference	Title/Principal Investigator
RG-LVT-297-1846	<u>Algebra</u> (Carlos Manuel Saiago)
RG-LVT-297-1849	<u>Differential Equations and Numerical Analysis</u> (Fabio Augusto da Costa Carvalho Chalub)
RG-LVT-297-1850	<u>Operations Research</u> (Maria Isabel Azevedo Rodrigues Gomes)
RG-LVT-297-3843	<u>Statistics and Risk Management</u> (Manuel Leote Tavares Ingles Esquivel)

6. 1. Algebra Team

Integrated Members

- Carlos Manuel Saiago
- Gonçalo Jorge Trigo Nery Tabuada
- Henry Liu
- Herberto de Jesus da Silva
- João Nuno Gonçalves Faria Martins
- Maria Helena Coutinho Gomes de Almeida Santos
- Teresa Maria Jerónimo Sousa

Collaborators Members

- Björn Gohla (Ph.D. student)
- João Leitão Guerreiro (Ph.D. student)
- Manuel Almeida Silva
- Maria Cecília Perdigão Dias da Silva

6. 1. 1. Funding, Source, Dates

Projects led by team Algebra members:

	Project Title	Principal Investigator	Team Members	Period	Total Funding
1. PTDC/MAT/113207/2009	"H-decompositions of graphs: two new problems"	Teresa Maria Jerónimo Sousa	Manuel Almeida Silva and Henry Liu	2011-2014	18.000 €

Led by other institutions, with participation of team Algebra members, eventually with no budget in our institution:

	Project title	Principal Investigator	Team Members	Period	Total Funding
1. PTDC/MAT/101503/2008	"New geometry and topology"	Roger Francis Picken	João Nuno Gonçalves Faria Martins	2010-2013	120.000 € (IST and Univ. Algarve)
2. PTDC/MAT/098770/2008	"Topological invariants via differential geometry"	Peter Beier Gothen	João Nuno Gonçalves Faria Martins and Björn Gohla	2010-2013	100.000 € (FCUP)

3. PTDC/MAT/098317/2008	"Algebraic topology and applications"	Pedro Ferreira dos Santos	Gonçalo Tabuada	2009-2013	53.740 € (FFCT/UNL)
4. PTDC/MAT/112273/2009	"Inverse Problems, Eigenvalues Multiplicities and Graphs"	António José Esteves Leal Duarte	Carlos Manuel Saiago	2011-2013	26.400 € (UC)
5. EXCL/MAT-GEO/0222/2012	"Geometry and Mathematical-Physics"	Miguel Tribolet Abreu	João Nuno Gonçalves Faria Martins	2012-2017	326.000 € (IST-ID)

6. 1. 2. Objectives

Integrated Members:

Carlos Saiago: Using the method of seeds and branch duplication we are studying if for every tree of diameter less than 7 there is a Hermitian matrix with as few as the diameter many distinct eigenvalues. It is known that for diameter 7, some trees require 8 distinct eigenvalues, but no more.

Gonçalo Tabuada: In 2013, the plan is to continue the development of the recent theory of noncommutative motives envisioned by Maxim Kontsevich.

Henry Liu: To continue to work on the research project H-decompositions of a graph (with Teresa Sousa): We study the following problem and its variants: Decompose a graph G into edge-disjoint copies of a graph H and single edges, as few as possible. To start at least one other research project.

Herberto Silva: Prosecute ongoing research on the following topics:

- 1) Congruences on Ockham algebras.
- 2) Strong endomorphism kernel property in Ockham algebras.
- 3) The lattice of subalgebras of an Ockham algebra.

João Faria Martins:

- 1) Finishing previous work on the geometry and topology of three-bundles and their parallel transport trifunctors.

- 2) Understanding infinitesimal 2-bradings and their appearance as being the classical limit of a weak crossed module of quasi-Hopf algebras. Understand further the case of the infinitesimal 2-brading coming from the categorification of the Kontsevich algebra of chord diagrams.
- 3) Understand harmonic analysis for categorical representations of crossed modules of groups in chain complexes of vector spaces, and prove a Peter-Weyl type theorem for irreducibles.

Maria Helena Santos: Investigate regular semigroups, semigroups with inverse transversals and ordered semigroups.

Teresa Sousa: Continue the research in decompositions of graphs, specially the monochromatic case.

Collaborators:

Cecília Perdigão: Research about the characteristic polynomial and eigenvalues of a matrix associated with a graph (star cycle).

Manuel Silva: To work in two Ramsey problems related with additive combinatorics. The first one is a variation of a Van der Waerden result on arithmetic progressions. The second one explores the connection with combinatorics of words.

6. 1. 3. Main Achievements

Integrated Members:

Carlos Saiago: The relation between perturbing the i th-diagonal entry of an $n \times n$ matrix A and extracting the principal submatrix $A(i)$ from A with respect to the possible changes in multiplicity of a given eigenvalue was completely characterized. Such research work led to the following paper published on Linear and Multilinear Algebra:

- Johnson, C. R., Leal-Duarte, A. and **Saiago, C. M.** (2012), *The change in eigenvalue multiplicity associated with perturbation of a diagonal entry*, Linear and Multilinear Algebra, 60 (5), 525-532.

Gonçalo Tabuada: Jointly with Matilde Marcolli (Caltech), proved a conjecture of Kontsevich concerning the semi-simplicity of the category of noncommutative numerical motives.

Henry Liu:

1) Two results from the project H-decompositions of a graph were proved, and two papers were written and submitted, one of which has been accepted for publication in Journal of Graph Theory in May 2013.

2) Many results from the project the rainbow connection number of a graph were proved, and three papers were written and submitted. One of the papers has been accepted for publication in Discrete Applied Mathematics in April 2013. A fourth paper from the same project (submitted before 2012) was also accepted for publication, in Journal of Combinatorial Mathematics and Combinatorial Computing, in March 2013.

Herberto Silva: Continuing the work of scientific research on Ockham algebras in the context of Universal Algebra and Theory Lattices, we have studied various problems about subalgebras of Ockham algebras. Initially it was considered the problem of describing the Ockham algebras that admit exactly two subalgebras, such algebras are called minimal. Accordingly, we obtained a complete description of the minimal Ockham algebras belonging to $K\omega$. Such research work led to the following publication:

- **Silva, H. J.** (2012), Minimal Ockham algebras, Algebra Universalis, Springer, 67 (4), 393-395.

URL: <http://link.springer.com/article/10.1007%2Fs00012-012-0193-0#page-1>

João Faria Martins:

- 1) Full understanding of the Gray category of functors, natural transformations, modifications and perturbations between a pair of Gray Categories.
- 2) Definition of invariants of knots from finite categorical groups, via Reidemeister pairings.
- 3) Example of an infinitesimal 2-Yang Baxter operator coming from the string Lie-2-algebra. Definition of an infinitesimal 2-braiding, and its relation with infinitesimal 2-Yang Baxter operators.

Maria Helena Santos: It was published the paper:

- Blyth, T. S., **Almeida Santos, M. H.** (2012), *H-cohesive orders associated with inverse transversals*, Communications in Algebra, 40 (8), 2771-2785.

Teresa Sousa: During 2012 the following papers have been published/accepted:

- **Sousa, T.** (2012), *4-Cycle Decompositions of Graphs*, Open Journal of Discrete Mathematics, 2 (4), 125-130.
- **Sousa, T.** (2012), *The H-Decomposition Problem for Graphs*, Applied Mathematics, 3 (11), 1719-1722.
- **Sousa, T.** (2012), *Friendship Decomposition of Graphs: The general problem*, Open Journal of Applied Sciences, 2 (4B), 30-33.
- **Liu, H.** and **Sousa, T.**, *Monochromatic K_r -Decompositions of Graphs*, to appear in Journal of Graph Theory.
- **Liu, H.**, **Mestre, A.** and **Sousa, T.**, *Rainbow vertex k-connection in graphs*, to appear in Discrete Applied Mathematics.

Collaborators:

Cecília Perdigão: Last year obtained a possible expression for the characteristic polynomial of a matrix associated with a graph (star cycle).

6. 1. 4. Group Productivity

6. 1. 4. 1. Book Chapter

Cabral, I., **Perdigão, C.**, **Saigo C.** (2012), *Álgebra Linear*, Escolar Editora, (3rd Edition), page 458, ISBN: 9789725923603.

6. 1. 4. 2. Publications in Peer Review Journals

1. Blyth, T. S., **Almeida Santos, M. H.** (2012), *H-cohesive orders associated with inverse transversals*, Communications in Algebra, 40 (8), 2771-2785 [Impact factor = 0.347].

URL: <http://dx.doi.org/10.1080/00927872.2011.585678>

2. Cirio, L. and **Faria Martins, J.** (2012), *Categorifying the Knizhnik-Zamolodchikov connection*, Differential Geometry and its Applications, 30 (3), 238-261 [Impact factor = 0.646].

URL: <http://www.sciencedirect.com/science/article/pii/S0926224512000071>

3. Johnson, C. R., Leal-Duarte, A. and **Saia**go, C. M. (2012), *The change in eigenvalue multiplicity associated with perturbation of a diagonal entry*, Linear and Multilinear Algebra, 60 (5), 525-532 [Impact factor = 0.727].

URL: <http://dx.doi.org/10.1080/03081087.2011.610973>

4. **Liu, H.** and **Sousa, T.**, *Monochromatic K_r -decompositions of graphs*, to appear in Journal of Graph Theory [Impact factor = 0.524].

5. **Liu, H.**, Mestre, A. and **Sousa, T.**, *Rainbow vertex k -connection in graphs*, to appear in Discrete Applied Mathematics [Impact factor = 0.795].

6. **Silva, H. J.** (2012), *Minimal Ockham algebras*, Algebra Universalis, Springer, 67 (4), 393-395 [Impact factor = 0.430].

URL: <http://link.springer.com/article/10.1007%2Fs00012-012-0193-0#page-1>

7. **Tabuada, G.** and Marcolli, M. (2012), *Kontsevich's noncommutative numerical motives*, Compositio Mathematica, 148 (6), 1811-1820 [Impact factor = 1.187].

URL: <http://journals.cambridge.org/action/displayAbstract?fromPage=online,aid=8764750>

8. **Tabuada, G.** and Cisinski, D. C. (2012), *Symmetric monoidal structure on noncommutative motives*, Journal of K-Theory, 9 (2), 201-268 [Impact factor = 0.750].

URL: <http://journals.cambridge.org/action/displayAbstract?fromPage=online,aid=8547265>

9. **Tabuada, G.** and Dell'Ambrogio, I. (2012), *Tensor triangular geometry of noncommutative motives*, Advances in Mathematics, 229 (2), 1329-1357 [Impact factor = 1.177].

URL: <http://www.sciencedirect.com/science/article/pii/S0001870811003793>

10. **Tabuada, G.** (2012), *The fundamental theorem via derived Morita invariance, localization, and A^1 -homotopy invariance*, Journal of K-Theory, 9 (3), 407-420 [Impact factor = 0.750].

URL: <http://journals.cambridge.org/action/displayAbstract?fromPage=online,aid=8489106>

11. **Tabuada, G.** (2012), *Transfer maps and projection formulas*, Proceedings of the American Mathematical Society, 140, 2589-2597 [Impact factor = 0.611].

URL: <http://www.ams.org/journals/proc/2012-140-08/S0002-9939-2011-11169-9>

12. **Tabuada, G.** (2012), *Weight structure on Kontsevich's noncommutative mixed motives*, Homology, Homotopy and Applications, 14 (2), 129-142 [Impact factor = 0.549].

URL: <http://projecteuclid.org/DPubS?service=UI,version=1.0,verb=Display,handle=euclid.hha/1355321484>

6. 1. 4. 3. Other International Publications

1. **Liu, H.**, *The balanced decomposition number of TK_4 and series-parallel graphs* (with Shinya Fujita), to appear in *Discussiones Mathematicae Graph Theory*.

2. **Sousa, T.** (2012), *4-Cycle decompositions of graphs*, *Open Journal of Discrete Mathematics*, 2 (4), 125-130.

URL: <http://dx.doi.org/10.4236/ojdm.2012.24024>

3. **Sousa, T.** (2012), *Friendship decompositions of graphs: The general problem*, *Open Journal of Applied Sciences*, 2 (4B), 30-33.

URL: <http://dx.doi.org/10.4236/ojapps.2012.24B008>

4. **Sousa, T.** (2012), *The H -decomposition problem for graphs*, *Applied Mathematics*, 3 (11), 1719-1722.

URL: <http://dx.doi.org/10.4236/am.2012.311237>

6. 1. 4. 4. Organization of Conferences

Recent Advances in Topological Quantum Field Theory, University of Lisbon, 10-14 September 2012.

URL: <http://gfm.cii.fc.ul.pt/events/conferences/tqft2012>

Organizing institutions:

Host: Grupo de Física Matemática of Universidade de Lisboa (GFM-UL)

Centro de Matemática e Aplicações of Universidade Nova de Lisboa (CMA-FCT/UNL)

Centro de Análise Matemática, Geometria e Sistemas Dinâmicos, Instituto Superior Técnico (CAMGSD-IST)

Organizers:

Atle Hahn (GFM-UL)

João Faria Martins (CMA-FCT/UNL)

Aleksandar Miković (GFM-UL/Universidade Lusófona)

Roger Picken (CAMGSD-IST)

6. 1. 5. Internationalization

6. 1. 5. 1. Publications

1. Cirio, L. and **Faria Martins, J.** (2012), *Categorifying the Knizhnik-Zamolodchikov connection*, Differential Geometry and its Applications, 30 (3), 238-261 [Impact factor = 0.646].
2. **Tabuada, G.** and Marcolli, M. (2012), *Kontsevich's noncommutative numerical motives*, Compositio Mathematica, 148 (6), 1811-1820 [Impact factor = 1.187].
3. **Tabuada, G.** and Cisinski, D. C. (2012), *Symmetric monoidal structure on noncommutative motives*, Journal of K-Theory, 9 (2), 201-268 [Impact factor = 0.750].
4. **Tabuada, G.** and Dell'Ambrogio, I. (2012), *Tensor triangular geometry of noncommutative motives*, Advances in Mathematics, 229 (2), 1329-1357 [Impact factor = 1.177].
5. **Tabuada, G.** (2012), *The fundamental theorem via derived Morita invariance, localization, and A^1 -homotopy invariance*, Journal of K-Theory, 9 (3), 407-420 [Impact factor = 0.750].
6. **Tabuada, G.** (2012), *Transfer maps and projection formulas*, Proceedings of the American Mathematical Society, 140, 2589-2597 [Impact factor = 0.611].
7. **Tabuada, G.** (2012), *Weight structure on Kontsevich's noncommutative mixed motives*, Homology, Homotopy and Applications, 14 (2), 129-142 [Impact factor = 0.549].

6. 1. 5. 2. Preprints

- Cirio, L. and **Martins, J. F.**, Categorifying the $\mathfrak{sl}(2, \mathbb{C})$ Knizhnik-Zamolodchikov Connection via an Infinitesimal 2-Yang-Baxter Operator in the String Lie-2-Algebra. arXiv:1207.1132 [hep-th].
- **Gohla, B.** and **Martins, J. F.**, Pointed homotopy and pointed lax homotopy of 2-crossed module maps. arXiv:1210.6519 [math.CT].
- **Martins, J. F.** and Picken, R., Link invariants from finite categorical groups and braided crossed modules. arXiv:1301.3803 [math.GT].

(i) Invited talks at international conferences

1. **Martins, J. F.**, Categorifying the Knizhnik-Zamolodchikov Connection, Conference 3Quantum: Algebra, Geometry, Information, Session Geometry and Topology in Quantum Gravity, Tallin, Estonia, July 2012.
2. **Tabuada, G.**, Conference Noncommutative algebraic geometry and its applications to physics, Leiden, Netherlands, March 2012;
3. **Tabuada, G.**, Conference Periods and Motives, Madrid, Spain, June 2012;
4. **Tabuada, G.**, Conference Arolla-Algebraic Topology, Arolla, Switzerland, August 2012;
5. **Tabuada, G.**, Conference Motives, Tokyo, Japan, December 2012.

(ii) Contributed talks at international conferences

1. **Liu, H.**, Rainbow Connection in Hypergraphs, Conference Bordeaux Graph Workshop, LaBRI, Université Bordeaux 1, Talence, France, November 2012;
2. **Liu, H.**, The k-rainbow Cycle Index of a Graph, Conference International Conference on Cycles in Graphs, Vanderbilt University, Nashville, USA, May/June 2012.
3. **Sousa, T.**, Friendship Decompositions of Graphs: The general problem, Conference Congress on Engineering and Technology, Beijing, China, October 2012;
4. **Sousa, T.**, The H-Decomposition Problem for Graphs, Conference: C2C-Progress in Applied Mathematics, Shanghai, China, August 2012.

(iii) Contributed talks at national conferences

Martins, J. F., Recent advances in topological quantum field theory, Categorifying the Knizhnik-Zamolodchikov connection, University of Lisbon, Lisbon, Portugal, September 2012.

6. 1. 6. Other Important Information

(i) Peer-reviewing activities

João Faria Martins

- Referee for Advances in Mathematics;
- Referee for Theory and Applications of Categories.

Herberto Silva

- Referee for the journal Algebra Universalis;
- Referee for the journal Glasgow Mathematical Journal;
- Review for Mathematical Reviews/MathSciNet.

Teresa Sousa

- Review for Discrete Mathematics;
- Review for Discussiones Mathematicae Graph Theory;
- Review for MATHSciNet.

(ii) Editing (of books and journals)

Teresa Sousa

Member of the editorial board Open Journal of Discrete Mathematics.

(iii) Supervision of Ph.D. (2012)

Björn Gohla

"Gray 3-grupoids and 2-crossed modules in homotopy theory and higher gauge theory",
Porto, 22 March 2013.

Supervisor: **João Nuno Martins**

Co-supervisor: Peter Gothen

6. 2. Differential Equations and Numerical Analysis Team

Integrated Members

- Ana Margarida Fernandes Ribeiro
- Bento José Carrilho Miguens Louro
- Fabio Augusto da Costa Carvalho Chalub
- José Maria Nunes de Almeida Gonçalves Gomes
- Maria do Céu Cerqueira Soares
- Maria de Serpa Salema Reis de Orey
- Maria Luísa Martins Macedo de Faria Mascarenhas
- Oleksiy Karlovykh
- Paula Cristiana Costa Garcia Silva Patrício Rodrigues
- Rita Alexandra Gonçalves Ferreira
- Rogério Ferreira Martins

Collaborators Members

- Alessandro Margheri
- Ana Cristina Melo e Sousa Albuquerque Barroso
- Ana Maria de Sousa Alves de Sá
- Ana Paula Barreira Pimenta (Ph.D. student)
- Carolin Claudia Kreisbeck
- Gonçalo Nuno Rosado Morais (Ph.D. student)
- Filipa Manuela Ventura Caetano
- João de Deus Mota da Silva Marques
- João Paulo de Carvalho Dias
- Jorge Filipe Drumond Pinto da Silva
- Jorge Manuel dos Santos Pacheco
- José Carlos Pedro Cardoso Matias
- Maria Carlota da Rocha Xavier Rebelo Gonçalves
- Maria Fernanda Alves da Veiga de Oliveira
- Mário Sequeira Rodrigues Figueira
- Paulo José Fernandes Louro Ribeiro Doutor
- Pedro Alves Martins da Silva Girão
- Luís Manuel Trabucho de Campos

- Telma Margarida Cotovio Guerra Santos (Ph.D. student)

6. 2. 1. Funding, Source, Dates

Projects led by team DENA members:

	Project Title	Principal Investigator	Team Members	Period	Total Funding
1. Project CMU-PT/0019/2007	"FCT/UNL Activities plan under the mathematics focus area of the CMU-Portugal Program"	Fabio Augusto da Costa Carvalho Chalub	Carolin Kreisbeck, Rita Ferreira, Ana Margarida Ribeiro and Maria Luísa Mascarenhas	2007-2012 (extended)	18.500 € (for the years 2011-2012) (CMU and FCT/Portugal)
2. PTDC/MAT/109973/2009	"Optimization methods in continuum mechanics"	Maria Luísa Martins Macedo de Faria Mascarenhas	Rita Ferreira, Luís Trabucho de Campos, Bento Louro, Maria do Céu Soares, Nadir Arada, Ana Margarida Ribeiro, Maria de Serpa Orey and Telma Margarida Santos	2011-2013	70.000 € (FFCT/UNL)
3. UTA_CMU/MAT/0005/2009	"Thin structures, homogenization and multi phase problems"	Maria Luísa Martins Macedo de Faria Mascarenhas	Carolin Kreisbeck, Ana Margarida Ribeiro and Rita Ferreira	2011-2013	168.200,00 € (FCT/Portugal and Carnegie Mellon University/ USA)

Led by other institutions, with participation of team DENA members, eventually with no budget in our institution:

	Project Title	Principal Investigator	Team Members	Period	Total Funding
1. PTDC/MAT/113383/2009	"Nonlinear dynamics of ordinary differential equations and applications"	Alessandro Margheri	Rogério Ferreira Martins and Gonçalo Nuno Rosado Morais	2011-2014	60.600 € (UL)
2. PTDC/MAT/114397/2009	"Non-linear degenerate elliptic equations and systems"	Diogo Luis de Castro Vasconcelos de Aguiar Gomes	José Maria Nunes de Almeida Gonçalves Gomes	2009- 2014	78.000 € (IST)
3. PTDC/SAU-ESA/71208/2006	"Molecular epidemiology of mycobacterium tuberculosis in Portugal: implementing and analysing a database"	Maria Gabriela Miranda Gomes	Paula Cristiana Costa Garcia da Silva Patrício Rodrigues	2008-2012 (extended)	171.750 € (FCG)
4. PTDC/FIS/101248/2008	"Co-evolution and self-organization of cooperation"	Francisco João Duarte Cordeiro Correia dos Santos	Fabio Augusto da Costa Carvalho Chalub	2010-2012	150.000 € (UNL)
5. PTDC/FIS/70973/2006	"Modeling of complex evolutionary processes"	Jorge Manuel dos Santos Pacheco	Fabio Augusto da Costa Carvalho Chalub	2009-2012 (extended)	65.000 € (UL)
6. UTAustin/MAT/0035/2008	"Analysis of nonlinear partial differential equations"	José Miguel Dordio Martinho de Almeida Urbano	Fabio Augusto da Costa Carvalho Chalub and Filipe Serra de Oliveira	2009-2013	100.000 € (University of Texas at Austin and FCT/ Portugal) (UC)
7. UTA_CMU/MAT/0007/2009	"Degenerate elliptic and parabolic equations and its applications to front propagation"	Diogo Luis de Castro Vasconcelos de Aguiar Gomes	Fabio Augusto da Costa Carvalho Chalub	2011-2014	209.997 € (IST)

6. 2. 2. Objectives

Specific activities of team members with perspectives for the next years are listed below:

A. M. Ribeiro and E. Zappale (Salerno, Italy) have been studying minimization problems in the supremal form. In this context the fundamental notion to ensure existence of solutions is the level convexity of the function defining the energy. Existence of solutions in the lack of this notion is being addressed. For the near future, in collaboration with F. Prinari and E. Zapalle, she intends to continue the study of supremal functionals enlarging their study to the more difficult case of vectorial problems.

B. Louro and M. C. Soares in collaboration with J. Henry (Bordeaux, France) have showed the well posedness of the Riccati equation arriving from the invariant embedding method applied to a Poisson problem in a quasi-cylindrical domain. A paper with these results will soon be submitted.

F. Chalub in collaboration with M. Souza (Niteroi, Brazil), developed rigorous theory of how to simplify detailed stochastic models of evolutions, providing, firstly diffusive approximations and finally, ODE-type models (e.g., the replicator dynamics). With O. Danilkina (post-doc in the program Multic EU/RUssia), degenerated diffusion approximations of discrete processes were studied with perturbative methods, providing existence theorems. From the diffusive approximation, it is possible to estimate fixation time for a population, however, formulas provided are not useful for experiments. For the near future, we plan to simplify these formulas using asymptotic expansions in the intensity of selection (the diffusive parameter).

F. Chalub, P. Rodrigues, M. C. Soares and P. Doutor started in 2013 to study the effect of voluntary vaccinations in seasonal epidemics. Both seasonal epidemics and effects of voluntary vaccinations are studied in the literature; to the best of our knowledge, however, both effects were never studied together.

J. M. Gomes has studied a classical variational framework known as the Nehari manifold related to the equation $-\Delta u=f(u)$ where f is non-linear and u satisfies Dirichlet boundary conditions on a regular domain Ω . The results may

be summarized as a local description of an infinite-dimensional hyper-surface in a Sobolev space $H^1_0(\Omega)$ using a generalized notion of principal curvature.

L. Mascarenhas and R. Ferreira in a joint work with A. Piatnitski (Norway), studied the asymptotic behavior of the spectrum of the Dirichlet-Laplace operator in thin periodically heterogeneous domains. This was part of R. Ferreira's Ph.D. thesis, successfully presented in July 2011 (joint degree FCT/UNL and CMU).

L. Mascarenhas in collaboration with G. Bouchitté (Toulon, France) and L. Trabucho (FCT/UNL), studied the eigenvalues of the Robin-Laplace operator in wave guides, using dimension reduction 3D-1D with respect to torsion, curvature and cross section. Localization effects due to asymmetries in the cross section were found.

L. Mascarenhas and C. Kreisbeck will finish soon the spectral analysis of wave guides in heterogeneous cross sections. For the case with periodic micro heterogeneities in the cross section of the same magnitude of the cross section some preliminary results were already obtained. Effects due to the curvature and torsions in the limit problem were obtained. The symmetric case was also studied. It is important to note that if there is no a priori symmetry, then concentration phenomena are observed.

Maria d'Orey presented successfully the Ph.D. thesis "Factorization of elliptic boundary value problems by invariant embedding and application to overdetermined problems". The thesis was defended at Universidade Nova de Lisboa. From the results obtained in this thesis, one paper is expected to be submitted during the year 2013.

O. Karlovich continues his study of the boundedness of the Cauchy singular integral operator on weighted variable Lebesgue spaces. Sufficient conditions for the Fredholmness of singular integral operators with semi-almost periodic coefficients on variable Lebesgue spaces were previously obtained. Jointly with Ilya Spitkovsky (College of William and Mary, VA, USA), we plan to prove that those Fredholm conditions are also necessary under more restrictive assumptions on a variable exponent. In a recent publication, it was proved that pseudodifferential operators (PDO) with symbols in a large subclass of the Hörmander class are bounded on variable exponent spaces. Moreover, some sufficient conditions for the Fredholmness of PDO with slowly oscillating symbols on variable exponent spaces are obtained. We are going to extend the latter boundedness result to a much more general class of Banach

functions spaces. Further, we plan to embark on the proof of necessary conditions for the Fredholmness of PDO with slowly oscillating symbols. Future research in collaboration with Amélia Bastos (Instituto Superior Técnico) and Cláudio Fernandes (FCT/UNL) includes the study of the Wiener-Hopf factorization of matrix-valued functions in decomposing locally bounded algebras.

T. Guerra continues her Ph.D. thesis "Optimal control of non-Newtonian fluids", supervised by L. Trabucho (FCT/UNL) and A. Sequeira (IST/UTL). The thesis consists in numerical simulations of control optimal problems based on Newtonian and non-Newtonian models. This study will be applied to fluid dynamics using Matlab. In particular, we will focus in 2D and 3D hemodynamics. Confrontation with real clinical data is planned using the boundary conditions as control variables.

6. 2. 3. Main Achievements

The number of papers in peer-reviewed journals is slowly increasing (6 papers in 2010, 8 papers in 2011 and 8 papers in 2012), representing, roughly, 1 paper per active Ph.D. member each 2 years.

During year 2012, one Ph.D. thesis was presented by Maria d'Orey.

There is no significant deviation with respect to the proposals in the 2011 report, due essentially to the fact that these are long term proposals. However, it is important to report that the teaching load is huge (circa 9 hours per week) and this has a negative impact in the scientific production.

Funding level is acceptable, although decreasing (mainly due to the economic situation in Portugal). The level of internationalization is high; most of the members have solid international contacts. The weaker point is the low level of collaboration between members, however this is increasing and is expected to increase even more in the next few years due to ongoing collaborations. The two most active areas of the group are homogenization (with three active Ph.D. members: L. Mascarenhas, A. M. Ribeiro and R. Ferreira) and applications to biology (with two Ph.D. members and one Ph.D. student: F. Chalub, P. Rodrigues and T. Guerra, and ongoing work involving more two Ph.D. members: M. C. Soares and P. Doutor). The post-doc expected to join the group will work in homogenizations; the two last post-docs, C. Kreisbeck and O. Danilkina

(who was not officially part of the group but collaborated with F. Chalub) worked in homogenization and applications to biology, respectively.

Scientific diffusion evolves many of the members, in the form of general public articles, seminars for high-school students, activities for children and teenagers.

6. 2. 4. Group Productivity

6. 2. 4. 1. Book Chapter

6. 2. 4. 1. 1. National

Soares, M. C. (2012), *Introdução ao Cálculo, Chapter 4 – Função exponencial e função logarítmica*, Escolar Editora, 161-189, ISBN 978-972-592-332-0.

6. 2. 4. 2. Publications in Peer Review Journals

1. Bouchitté, G., **Mascarenhas, L.** and Trabucho, L. (2012), *Thin waveguides with Robin boundary conditions*, J. Math. Phys., 53 (12) [Impact factor = 1.291].

URL: <http://dx.doi.org/10.1063/1.4768462>

2. Casquilho, J. P. and **Martins, R.** (2012), *On the stability of shear flows in nematics*, Theoretical and Computational Fluid Dynamics, 26 (1), 381-389 [Impact factor = 1.034].

URL: <http://link.springer.com/article/10.1007%2Fs00162-011-0236-8>

3. **Chalub, F. A. C. C.** and M. O. Souza, *The frequency-dependent Wright-Fisher model: diffusive and non-diffusive approximations*, to appear in Journal of Mathematical Biology [Impact factor = 2.963].

URL: <http://arxiv.org/abs/1107.1549>

4. **Ferreira, R.** and Fonseca, I. (2012), *Characterization of the multiscale limit associated with bounded sequences in BV*, J. Convex Anal., 19 (2), 403-452 [Impact factor = 0.823].

URL: <http://www.heldermann.de/JCA/JCA19/JCA192/jca19023.htm>

5. **Ferreira, R.** and Fonseca, I. (2012), *Reiterated homogenization in BV via multiscale convergence*, SIAM J. Math. Anal., 44 (3), 2053-2098 [Impact factor = 1.316].

URL: <http://epubs.siam.org/doi/abs/10.1137/110826205>

6. **Ferreira, R., Mascarenhas, L.** and Piatnitski, A. (2012), *Spectral analysis in a thin domain with periodically oscillating characteristics*, ESAIM: Control, Optimisation and Calculus of Variations, 18 (2), 427-451 [Impact factor = 0.758].

URL: <http://dx.doi.org/10.1051/cocv/2011100>

7. **Gomes, J. M.** (2012), *A geometrical view of the Nehari manifold*, Methods and Applications of Analysis, 19 (2), 187-210, 2012.

URL: <http://intlpress.com/site/pub/pages/journals/items/maa/content/vols/0019/0002/00024296/index.html>

8. Gomes, M. G., Aguas, R., Lopes, J. S., Nunes, M. C., Rebelo, C., **Rodrigues, P.** and Struchiner, C. J. (2012), *How host heterogeneity governs tuberculosis reinfection?*, Proceedings Of The Royal Society B-Biological Sciences, 279 (1737), 2473-2478 [Impact factor = 5.415].

9. **Guerra, T.** (2012), *Distributed control for shear-thinning non-Newtonian fluids*, Journal of Mathematical Fluid Mechanics, 14 (4), 771-789 [Impact factor = 0.786].

URL: <http://link.springer.com/article/10.1007%2Fs00021-012-0101-6>

10. **Kreisbeck, C., Conti, S.** and Dolzmann, G., *Relaxation of a model in finite plasticity with two slip systems*, to appear in Mathematical Models and Methods in Applied Sciences [Impact factor = 1.635].

URL: <http://dx.doi.org/10.1142/S0218202513500279>

11. **Kreisbeck, C.,** *Another approach to the thin-film Gamma-limit of the micromagnetic free energy in the regime of small samples*, to appear in Quart. Appl. Math. [Impact factor = 0.524].

URL: <http://dx.doi.org/10.1090/S0033-569X-2012-01323-5>

12. **Ribeiro, A. M.** and Zappale, E., *Relaxation of certain integral functionals depending on strain and chemical composition*, to appear in Chinese Annals of Mathematics, Ser. B. [Impact factor = 0.521].

6. 2. 4. 3. Other International Publications

6. 2. 4. 3. 1. Conference Proceedings with Peer-Review

Rodrigues, P., Rebelo, C. and Gomes, M. G. M., Multi-scale models for drug resistant tuberculosis, Proceedings of International Conference on Computational and Mathematical Methods in Science and Engineering, CMMSE 2012, Murcia, Spain, 1071-1082, 2012, ISBN 978-84-615-5392-1.

6. 2. 4. 3. 2. Conference Proceedings

1. **Chibeles-Martins, N.**, Rodrigues, F. and **Soares, M. C.** (2012), *MathGames*, Recreational Mathematics Colloquium II, Conference Proceedings 2012, 169-174, ISBN 978-989-97346-2-3.

2. Henry, J., **Louro, B.** and **M. C. Soares** (2012), *A factorization method for elliptic BVP2*, Proceedings of the 12th International Conference on Computational and Mathematical Methods in Science and Engineering, CMMSE 2012, Vol. II, 709-714, 2-6 July 2012.

3. **Ribeiro, A. M.** and Zappale, E., *Lower semicontinuous envelopes in $W^{1,1} \times L^q$* , submitted to Proceedings of the International Conference on Calculus of Variations and PDEs, Szczawnica, Poland, July 2012.

URL:

6. 2. 4. 4. Ph.D. Theses Completed

Maria d'Orey

"Factorization of elliptic boundary value problems by invariant embedding and application to overdetermined problems", Caparica, 22 November 2012.

Supervisor: Jacques Henry

Co-supervisor: **Bento Louro**

6. 2. 4. 5. Organization of Conferences

CoLab Mathematics Summer School and Workshop, Caparica, Portugal, 2-13 July 2012.

URL: <http://math.utaustinportugal.org/summer2012>

6. 2. 5. Internationalization

(i) Posters

C. Kreisbeck, (jointly with L. Mascarenhas), *Asymptotic spectral analysis in quantum waveguides with heterogeneous fibers*, Mathematics for Semiconductor Heterostructures, Modeling, Analysis and Numerics, Berlin, September 2012.

6. 2. 6. Other Important Information

(i) Peer-reviewing activities

Maria Luísa Mascarenhas

- Referee for Applicable Analysis.

6. 3. Operations Research Team

Integrated Members

- Ana Luísa da Graça Batista Custódio
- Isabel Cristina Silva Correia
- Manuel Valdemar Cabral Vieira
- Maria do Carmo Proença Caseiro Brás
- Maria Isabel Azevedo Rodrigues Gomes
- Nelson Fernando Chibeles Pereira Martins
- Paula Alexandra da Costa Amaral
- Rui Alberto Pimenta Rodrigues
- Susana Maria Marques Henriques Botelho Baptista

Collaborators Members

- Ana Paula Ferreira Dias Barbosa da Póvoa

6. 3. 1. Funding, Source, Dates

Projects led by other institutions, with participation of team OR members, eventually with no budget in our institution:

	Project Title	Principal Investigator	Team Members	Period	Total Funding
1. PTDC/MAT/098214/2008	"Derivative-free optimization: future challenges and new applications"	Luís Nunes Vicente	Ana Luísa Custódio	2010-2013	158.256 € (UC)
2. PTDC/SEN-ENR/102869/2008	"PEERChain-design and planning of energy efficient and resilient supply chains"	Ana Paula Póvoa	Maria Isabel Gomes, Nelson Martins and Susana Baptista	2010-2013	199.991 € (IST)
3. PTDC/MAT/116736/2010	"Sparse and Smoothing Methods for Nonlinear Optimization of Complex Models"	Luís Nunes Vicente	Ana Luísa Custódio	2012-2015	78 500 € (UC)

6. 3. 2. Objectives

For the year of 2013, the OR Team will pursue the development of research in the two key areas of Non-Linear Optimization and Combinatorial Optimization, focusing on many different problems such as the:

- Eigenvalue Complementarity Problems
- Satisfiability Problem
- Constrained Fractional Quadratic Problems
- Design and Planning of Supply Chains
- Hub Location Problems
- Multi-depot, Multi-product Vehicle Routing Problems
- Resource Constraint Project Scheduling Problem
- Biomedical Signal Processing
- Forecast of Energy Consumption and Energy Management.

For each, specific aspects will be studied and new developments will be proposed, namely:

- the study of Second-Order Cone Eigenvalue Complementarity Problems (SOCEiCP) for the Lorentz Cone and other convex cones for EiCP will be pursued;
- the satisfiability problem (SAT) and its relation with Farkas' certificate of infeasibility will be further investigated. In particular we will address new connections between SAT and SDP. Previous research has shown that SDP can be a useful tool for solving SAT. When the SDP relaxation is infeasible, we can exhibit a proof in the form of an SDP certificate of infeasibility. Until now, this certificate was only used to prove unsatisfiability, but no other information was extracted from it. The first objective will be to investigate how to extract the combinatorial information contained in the certificate of infeasibility for the SDP relaxation of an arbitrary unsatisfiable instance. A second objective is to investigate the closely related question of how to use the SDP certificate of infeasibility to identify a minimal unsatisfiable subformula (MUS). By using an SDP-based approach, we propose ourselves to develop an approach that is global in nature and captures the entire information about the instance in the SDP

relaxation. The successful completion of this research will open the way for the development of a global approach to the problem of identifying MUSes;

- the development of algorithmic in derivative-free optimization with application on global optimization. Locating and identifying points as global minimizers is, in general, a hard and time-consuming task. Difficulty increases when the derivatives of the functions defining the problem are not available for use. We intend to finalize the development, analysis and numerical testing of a new algorithm (GLODS: Global and Local Optimization by Direct Search) suited for constrained, derivative-free, global optimization. Using direct search of directional type, the method alternates between a search step, where potentially good regions are located, and a poll step where the previously located regions are explored. This exploitation is made through the launching of several directional direct search methods, one in each of the regions of interest. Differently from a multistart strategy, the several directional direct search methods will merge among them when sufficiently close to each other. The goal is to end with as many active points as the number of local minimizers, which would allow to easily locating the possible global extreme value.
- the study of optimization of noisy functions in the absence of derivatives is to be initiated. In engineering it is not difficult to find applications where the objective function is contaminated by noise. This constitutes an additional challenge to a class of problems already difficult by themselves. In a first approach we intend to assume the knowledge of a maximum level for the noise and use this information to overcome the spurious minimums resulting from it;
- the development of Branch and Bound methods for constrained fractional quadratic problems. Lower bounds based on conic relaxations will be applied together with good branching strategies;
- the study of the correction of infeasible systems will continued to be investigated. Finding clusters of feasible constraints is an important tool in inconsistency analysis. The problem can be formulated as mixed integer nonlinear optimization problem and Benders Decomposition approaches are investigated;
- the development of facility location models and meta-heuristics for the design of supply chains networks where aspects such as environmental impacts,

uncertainty and resilience will be deepened. In detail, the modeling of uncertainty in supply chains will be explored by developing multi-stage stochastic models and several addressing risk measurements. Regarding resilience we aim at further investigate the quality of the already proposed metrics and to develop new ones;

- the work on the study of hub location problems, on multi-depot, multi-product vehicle routing problems will be carried on,
- the study new variants of the resource constraint project scheduling problem;
- the research on biomedical signal processing where convolutional feed forward neural networks and recurrent neural networks will be further investigated. Moreover, in context of the PhysioNet/CinC Challenge 2013, we aim at developing a method for detecting fetal QRS in an abdominal maternal ECG;
- a new collaboration with Coimbra and Vila Real University researchers and TULAES (private firm) is starting and will address the forecast of energy consumption and energy management.

Other than the research objectives aforementioned, the group aims to increase internal collaboration within its members, so that the sharing of scientific expertise will leverage not only members' engagement but also increase the number of publications.

In the context of the internationalization, the group intends to deepen and enlarge its present collaborations (8 in total) and to enhance its visibility within the international OR community, not only by supporting the participation of its members in scientific meetings, but also by promoting and organizing scientific events within the campus. In this sense, during the year of 2013 we will host the ICCOPT conference at our faculty. The group is responsible for the local organization of the event where more than 450 participants are expected. As a satellite event the group will host a two-day school on continuous optimization lectured by professors Michael Ulbrich and Christian Meyer, from TU of Dortmund (Germany), and Mário A. T. Figueiredo from Technical University of Lisbon and IT (Portugal) and Stephen J. Wright from University of Wisconsin (USA). A total of 150 participants are expected to attend this event. A national one-day course on stochastic optimization is also been prepared in collaboration with Professor Laureano Escudero from Universidad Rey Juan Carlos, Madrid, Spain.

The group seminar will continue during 2013.

Finally, science promotion is also one of the interest areas of the group, so different group members are enrolled in the organization of activities addressed to encourage popular interest and develop abilities in Mathematics, namely MatNova, ClubeMat, and EXPOFACT.

6.3.3. Main Achievements

The **modeling and optimization of facility location and supply chains** addressed several topics where forward and closed-loop supply chains have been studied:

- Performance metrics: strategic decisions are subject to a given budget and concern the location of new facilities in the upper and intermediate echelons of the network as well as the installation of storage areas to handle different product families. A finite set of capacity levels for each product family is available at each potential location. Further decisions concern the quantities of products to be shipped through the network. Two mixed-integer linear programming models were proposed differing in the type of performance measure that is adopted to design the supply chain.
- Multiobjective optimization: development of a social benefit indicator is being developed where the creation of employment in less developed regions is preferred; the multiobjective approach is used to reach a solution of compromise between the three sustainability pillars: economic, environmental and social. The undergoing work is being applied to a case study developed in collaboration with a Portuguese company, leader in battery production.
- Uncertainty/stochastic: Uncertainty was explicitly modeled by considering customers' demands and returns to be stochastic. A two-stage model was developed where first stage decisions concern the facility location while second stage decisions are the production planning of the supply chain. The integer L-shaped method was adopted as the solution tool and computational tests were performed on multi-period and multi-commodity networks randomly generated based on a reference case. A comparison between the proposed solution method and the straight use of the CPLEX was performed.

- Resilience: the effect of disruptions and modifications in the operating conditions of CLSCs are being investigated on the basis of a 2-stage scenario based model previously developed. Metrics derived from graph theory are being used, along with more conventional economic and operational indices. The goal is to understand how resilience metrics can be developed and how to integrate them in supply chain design.
- Ant-Colony metaheuristic: an algorithm based on ant-colony was developed in order to model a multi-product closed-loop supply chain. The results were compared with the ones provided by CPLEX. The model was extended to contemplate piece-wise transportation costs, modular capacities and non-linear distances dependent costs.
- Hub location problem: a capacitated single-allocation hub location problem where multiple products are to be shipped through the network was addressed assuming a modeling framework in which no more than one hub can be located in each node. In particular the case in which all hubs are dedicated to handling a single-product as well as the case in which all hubs can handle all products was investigated. Several mixed-integer linear programming formulations were proposed as well as a set of inequalities that can be used to strengthen the models in terms of the lower bound provided by the linear relaxation.

Concerning the study of routing problems two different cases were addressed:

- the dial-a-ride problem: two different models were proposed using Constraint Programming methodology, with distinct domains: graphs and finite (integer). The purpose of these models was to respond to a static version of DARP, with time windows, a heterogeneous fleet and concerns about service quality;
- the vehicle routing problem in waste collection systems: new exact formulations and new solution's approaches were developed. These support tactical and operational planning decisions, such as, delimitation of depots' service areas, routes definition and routes assignment and scheduling, in logistics networks with multiple depots. This study addressed three characteristics of logistics networks which have been seldom studied: type of routes (closed versus open); number of products (single versus multiple) and objective function (economical versus environmental versus social).

Moreover the resource constrained project scheduling problem was studied assuming the cost minimization for the project scheduling problem with flexible resources. In this problem each resource can perform at least one skill. This is often the case when human resources are involved. In this study, a mathematical modeling framework was developed that considers different cost structures for the resources.

In health care, the method developed in 2010 to approximate a biomedical signal having a different simultaneous biomedical signal from the same patient as baseline turned out to be robust to noise on the input signal. As a consequence a method to denoise ECG was developed.

Concerning the modeling and algorithm development in nonlinear optimization the work on complementary optimization and semidefinite programming (SDP) achieved some interesting results. In particular, the Inverse Eigenvalue Complementarity Problem (IEiCP) was addressed as a global optimization problem. Two nonlinear programming formulations of the IEiCP were developed and an enumerative algorithm that assures global convergence was proposed. Concerning the SDP studies, the work developed in 2012 have had as baseline a published result where it is proven that certificate of infeasibility for linear programming can be obtained as the solution of a non-negative least squares problem (residual vector of the linear constraints). This result to SDP, and in fact, there is a one-to-one correspondence between each coordinate of the SDP certificate and each linear constraint in the SDP relaxation. We explored in detail the relationship between the entries of the SDP certificate of infeasibility and the clauses. We interpreted each entry of SDP certificate of infeasibility as the "weight" of each clause in the propositional formula. We have been able to identify some pattern in the residual vectors, which identify problematic clauses in a propositional formula or which clauses are "harder to satisfy...".

Regarding derivative-free optimization, first results related to the convergence analysis of an algorithm for global optimization were derived and a first numerical implementation was finalized. A test set of global optimization problems was collected, in order to be able to numerically test the implementation.

In the area of multiobjective derivative-free optimization, a review on recent developments was conducted describing major distinct approaches that are currently

being followed to tackle these problems: Direct Search Methods of directional type and Evolutionary Multiobjective Optimization algorithms. For each of these classes, the most relevant algorithms were described, pointing out strengths and weaknesses, and mentioning some of the improvements that could be considered. A discussion about differences and similarities between the two classes was also conducted.

Investigation on fractional quadratic problems pursued with the development of solution methods. Applications of nonlinear optimization models to in the design of electronic circuits have been addressed.

During the year of 2012, the group published 8 papers in ISI journals. The group participated in several national and international meetings being published 6 papers in proceedings with peer review. Two of its members were invited to present talks at international meetings. The group contributed with 9 talks and 1 poster at international conferences, and 2 talks at national conferences. Lastly, one book chapter and one scientific report were published in 2012.

Some of the group members were involved in conference comities as organizers or scientific members. Two group members integrated international evaluation panels of scientific projects. In terms of editorial activities, two group members were made in charge of the Bulletin of the Portuguese Association of Operations Research.

One master thesis and one Ph.D. thesis supervised by group members were completed during 2012.

6. 3. 4. Group Productivity

6. 3. 4. 1. Book Chapter

Custódio, A. L., Emmerich, M. and Madeira, J. F. A. (2012), *Recent developments in derivative-free multiobjective optimisation*, Computational Technology Reviews, ed. B. H. V. Topping, Saxe-Coburg Publications, 5, 1-30.

URL: <http://www.ctresources.info/ctr/paper.html?id=37>

6. 3. 4. 2. Publications in Peer Review Journals

1. **Baptista, S.** and Oliveira, R., (2012), *A case study on the application of an approximated hypercube model to emergency medical systems management*, Central European Journal Of Operations Research, 20 (4), 559-581 [Impact factor = 0.484].

URL: <http://link.springer.com/article/10.1007%2Fs10100-010-0187-y>

2. **Brás, C. P.**, Fukushima, M., Júdice, J. J. and Rosa, S. S. (2012), *Variational inequality formulation of the asymmetric eigenvalue complementarity problem and its solution by means of gap functions*, Pacific Journal of Optimization, 8 (2), 197-215 [Impact factor = 0.527].

URL: <http://www.ybook.co.jp/online2/oppjo/vol8/p197.html>

3. **Correia, I.**, Lourenço, L. and Saldanha da Gama, F. (2012), *Project scheduling with flexible resources: formulation and inequalities*, OR Spectrum, 34, 635-663 [Impact factor = 1.233].

URL: <http://link.springer.com/content/pdf/10.1007%2Fs00291-010-0233-0>

4. Pais, T. and **Amaral, P.** (2012), *Managing the tabu list length using a fuzzy inference system: an application to examination timetabling*, Annals of Operations Research, 194 (1), 341-363 [Impact factor = 0.840].

URL: <http://link.springer.com/article/10.1007%2Fs10479-011-0867-6?LI=true>

5. Vicente, L. N. and **Custódio, A. L.** (2012), *Analysis of direct searches for non-Lipschitzian functions*, Mathematical Programming, 133 (1-2), 299-325 [Impact factor = 1.707].

URL: <http://link.springer.com/article/10.1007/s10107-010-0429-8>

6. **Vieira, M. V. C.** (2012), *Interior-point methods based on Kernel functions for symmetric optimization*, Optimization Methods and Software, 27 (3), 13-537 [Impact factor = 0.651].

URL: <http://dx.doi.org/10.1080/10556788.2010.544877>

7. **Vieira, M. V. C.** (2012), *The accuracy of interior-point methods based on Kernel functions*, Journal of Optimization Theory and Applications, 155 (2), 637-649 [Impact factor = 1.062].

URL: <http://dx.doi.org/10.1007/s10957-012-0071-0>

8. Zeballos, L. J., **Gomes, M. I.**, Barbosa-Póvoa A. P. and Novais A. Q. (2012), *Addressing the uncertain quality and quantity of returns in closed-loop supply chains*, Computers and Chemical Engineering, 47, 237-247 [Impact factor = 2.320].

URL: <http://linkinghub.elsevier.com/retrieve/pii/S0098135412002189>

6. 3. 4. 3. Other International Publications

Ramos, T. R. P., **Gomes, M. I.** and Barbosa-Póvoa A. P. (2012), *Minimizing CO₂ emissions in a recyclable waste collection system with multiple depots*, in proceedings of EUROMA/POMS Joint Conference, Amsterdam, Netherlands (web-edition).

6. 3. 4. 3. 1. Conference Proceedings with Peer-Review

1. **Baptista, S., Gomes, M. I.,** Barbosa-Póvoa, A. P. (2012), *A two-stage stochastic model for the design and planning of a multi-product closed loop supply chains*, Computer Aided Chemical Engineering, 30, 412-416.

URL: <http://www.sciencedirect.com/science/article/pii/B9780444595195500836>

2. **Chibeles-Martins, N.,** Pinto-Varela, T., Barbosa-Póvoa, A. P., Novais, A.Q. (2012), *A simulated annealing algorithm for the design and planning of supply chains with economic and environmental objectives*, Computer Aided Chemical Engineering, 30, 21-25.

URL: <http://www.sciencedirect.com/science/article/pii/B9780444595195500058>

3. **Correia, I.,** Melo, T., Saldanha da Gama, F. (2012), *A two-echelon facility location problem with layout selection*, Proceedings of the 14th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems, Porto, Portugal, 79-84. Series title: Mathematics and Computers in Science and Engineering 3, 1-3 July 2012.

URL:

<http://www.wseas.us/e-library/conferences/2012/Porto/MAMECTIS/MAMECTIS-12.pdf>

4. Esteves, V. M. C., Sousa, J. M. C., Silva, C. A., Povoia, A. P. B. and **Gomes, M. I.** (2012), *SCant-design: closed loop supply chain design using ant colony optimization*, in 2012 IEEE Congress on Evolutionary Computation (CEC), Brisbane, Australia.

5. Zeballos, L. J., **Gomes, M. I.,** Barbosa-Póvoa, A. P. and Novais, A. Q. (2012), *Optimum design and planning of resilient and uncertain closed-loop supply chains*, Computer Aided Chemical Engineering, 30, 407-411.

URL: <http://www.sciencedirect.com/science/article/pii/B9780444595195500824%20>

6. 3. 4. 4. Technical Report

Correia, I., Melo, M. T., Saldanha da Gama, F. (2012), *Comparing classical performance measures for a multi-period, two-echelon supply chain network design problem with sizing decisions*, Technical Report 1 on Logistics, Saarland Business School, Saarland, Germany.

6. 3. 4. 5. M.Sc. Theses Completed

Nuno Cunha

"Optimização do transporte de doentes num serviço porta à porta", Caparica, 14 November 2012.

Supervisor: Francisco Azevedo (DI-FCT)

Co-supervisor: **Isabel Gomes** (FCT-UNL)

6. 3. 4. 6. Ph.D. Theses Completed

Tânia Rodrigues Pereira Ramos

"Tactical and Operational Planning in Reverse Logistics Systems with Multiple Depots", Lisbon, 11 December 2012.

Supervisor: Ana Póvoa (IST)

Co-supervisor: **Isabel Gomes** (FCT-UNL)

6. 3. 4. 7. Organization of Conferences

1. Ana Luísa Custódio: Sessions Organizer -"Optimização e Investigação Operacional", National Meeting of the Sociedade Portuguesa de Matemática 2012, Faro, Portugal, 9-11 July 2012.

URL: <http://enspm12.spm.pt/pt>

2. Isabel Correia: Organizer of the Operations Research Seminar, Centro de Matemática e Aplicações.

URL: <http://www.dm.fct.unl.pt/node/462>

3. Paula Amaral: Member of the Program Committee of the 12th International Conference on Computational Science and Its Applications (ICCSA 2012), Bahia, Brazil, 18-21 June 2012.

URL: <http://2012.iccsa.org/committees>

4. Summer School in Mathematics, MatNova2012, 4-8 September 2012.

URL: <http://eventos.fct.unl.pt/matnova2012/home>

Organizing Committee: Ana Cristina Casimiro, Ana Luísa Custódio, Cláudio Fernandes, Manuel Messias, Maria do Céu Soares and Maria de Fátima Rodrigues.

6.3.5. Internationalization

(i) Invited talks at international conferences

1. **Custódio, A. L.**, Madeira, J. F. A., Vaz, A. I. F. and Vicente L. N., *Direct multisearch: a robust and efficient approach to multiobjective derivative-free optimization*, 21st International Symposium on Mathematical Programming, Berlin, Germany, 2012.

URL: <http://ismp2012.mathopt.org>

2. **Vieira, M. V. C.** (2012), *Relationships between minimal unsatisfiable subformulas and semidefinite certificates of infeasibility*, ISMP2012, TU Berlin, Berlin, Germany, 2012.

(ii) Contributed talks at international conferences

1. **Amaral, P.**, *Global optimization simplex bisection revisited based on considerations by Reiner Horst*, ICCSA2012, Brazil, 2012.

2. **Baptista, S., Gomes, M. I.** and Barbosa-Póvoa, A. P., *A two-stage stochastic model for the design and planning of a multi-product closed loop supply chains*, in ESCAPE 22, London, U.K., 2012.

3. **Chibeles-Martins, N.**, *A simulated annealing algorithm for the design and planning of supply chains with economic and environmental objectives*, ESCAPE22, London, U.K., 2012.

4. **Correia, I.**, Nickel, S. and Saldanha da Gama, F., *Hub and spoke network design with single-assignment, capacity decisions and balancing requirements*, EURO XXV-25th European Conference on Operational Research, Vilnius, Lithuania, 2012.

5. **Correia I.**, Melo, T. and Saldanha da Gama, F., *Comparing classical performance measures for a multi-period logistics network design problem*, EURO XXV-25th European Conference on Operational Research, Vilnius, Lithuania, 2012.
6. **Correia, I.**, Melo, T. and Saldanha da Gama, F., *A two-echelon facility location problem with layout selection*, 14th International Conference on Mathematical Methods, Computational Techniques and Intelligent Systems, Porto, Portugal, 2012.
7. Esteves, V. M. C., Sousa, J. M. C., Silva, C. A., Barbosa-Póvoa, A. P. and **Gomes, M. I.**, *SCant-design: closed loop supply chain design using ant colony optimization*, 2012 IEEE Congress on Evolutionary Computation (CEC), Brisbane, Australia, 2012.
8. Ramos, T. R. P., **Gomes, M. I.** and Barbosa-Póvoa, A. P., *Minimizing CO₂ emissions in a recyclable waste collection system with multiple depots*, EUROMA/POMS Joint Conference, Amsterdam, Netherlands, 2012.
9. Zeballos, L. J., **Gomes, M. I.**, Barbosa-Póvoa, A. P., Novais, A. Q., *Optimum design and planning of resilient and uncertain closed-loop supply chains*, in Escape 22, London, U.K., 2012.

(iii) Contributed talks at national conferences

1. **Gomes, M. I.** and Barbosa-Póvoa A. P., *Distribution network optimization considering economical and environmental objectives*, COA.pt, Sabrosa, Portugal, 2012.
2. **Vieira, M. V. C.** (2012), *Relações entre fórmulas proposicionais mínimas e certificados de inadmissibilidade em programação semidefinida*, National Meeting of the Sociedade Portuguesa de Matemática, Universidade do Algarve, Faro, 9-11 July 2012.

(iv) Posters

Zeballos, L. J., **Gomes, M. I.**, Barbosa-Póvoa, A. P. and Novais, A. Q., *Optimum design and planning of resilient and uncertain closed-loop supply chains*, in FOCAPO, Savannah, USA, 2012.

(v) Invited seminars in other research units

Vieira, M. V. C., *Relações entre fórmulas proposicionais mínimas e certificados de inadmissibilidade em programação semidefinida*, Operations Research Seminar, Caparica, 2012.

6. 3. 6. Other Important Information

(i) Peer-reviewing activities

Acta Mathematica Scientia;

Computational Optimization and Applications;

Computers and Chemical Engineering;

Computers and Operations Research;

European Journal of Operational Research;

Journal of Global Optimization;

Journal of Optimization Theory and Applications;

Omega;

Optimization and Engineering;

SIAM Journal on Optimization;

"Investigação Operacional em Ação – Casos de Aplicação", ed. J. S. Ferreira and R. C. Oliveira (edited book).

(ii) Research Panels

1. Member of the proposal evaluation panel of the 2012 call for research proposals of the National Research Council of Romania – CMA member: A. L. Custódio;

2. Member of the proposal evaluation panel of the 2012 call for research proposals of the Czech Science Foundation – CMA member: M. I. Gomes.

(iii) Boards

Member of the Executive Board of the Portuguese Association of Operations Research (APDIO), since January 2012 – CMA member: A. L. Custódio.

(iv) Editorial Activity

Editors of the Bulletin of the Portuguese Association of Operations Research (APDIO), since February 2012 – CMA members: A. L. Custódio and I. Correia.

(v) Scientific Committees

Member of the Scientific Committee of the conference EngOpt 2012, Rio de Janeiro, Brazil, 1-5 July 2012 – CMA member: A. L. Custódio.

6. 4. Statistics and Risk Management Team

Integrated Members

- Ayana Maria Xavier Furtado Mateus
- Carlos Manuel Agra Coelho
- Carlos Manuel Antunes Veiga
- Célia Maria da Silva Fernandes
- Dora Susana Raposo Prata Gomes
- Elsa Estevão Fachadas Nunes Moreira
- Filipe José Gonçalves Pereira Marques
- Francisco Paulo Vilhena Antunes Bernardino Carvalho
- Frederico Almeida Gião Gonçalves Caeiro
- Gonçalo José Nunes dos Reis
- Gracinda Rita Diogo Guerreiro
- João Filipe Lita da Silva
- João Tiago Praça Nunes Mexia
- José Moniz Lopes Fernandes
- Luís Miguel Lindinho da Cunha Mendes Grilo
- Luís Pedro Carneiro Ramos
- Manuel Leote Tavares Inglês Esquível
- Maria de Lourdes Belchior Afonso
- Marta Cristina Vieira Faias Mateus
- Miguel de Carvalho
- Miguel dos Santos Fonseca
- Paulo Jorge Canas Rodrigues
- Paulo José Raimundo Ramos
- Pedro José dos Santos Palhinas Mota
- Ricardo Jorge Viegas Covas
- Rui Manuel Rodrigues Cardoso
- Vanda Marisa da Rosa Milheiro Lourenço
- Vera da Conceição Vilelas Montes de Jesus

Collaborators Members

- Alberto Adrego Pinto

- Célia Maria Pinto Nunes
- Cláudia Vanessa Rosa Leitão de Macedo Roçadas
- Dário Jorge da Conceição Ferreira
- Dina Maria Morgado Salvador (Ph.D. student)
- Inês Jorge da Silva Sequeira
- Iola Maria Silvério Pinto
- João Beleza Teixeira Seixas e Sousa (Ph.D. student)
- Philippe Laurent Didier
- Rui Manuel Pesado Alberto
- Rute Alexandra Baião Carrujo (Ph.D. student)
- Sandra Cristina Dias Nunes
- Sandra Inês da Cunha Monteiro (Ph.D. student)
- Sandra Maria Bargão Saraiva Ferreira

6. 4. 1. Funding, Source, Dates

Projects led by other institutions, with participation of team SRM members, eventually with no budget in our institution:

	Project Title	Principal Investigator	Team Members	Period	Total Funding
1. Project number 226544	"Models for adaptive forest management"	José G. Borges	Ayana Furtado	2009-2013	9.071 € (European Commission)
2. PTDC/MAT/101736/2008	"Extrema: statistical extremes in today's world"	Maria Ivette Leal de Carvalho Gomes	Dora Susana Raposo Prata Gomes and Frederico Almeida Caeiro	2010-2013	89.520 € (UL)
3. PTDC/EGE-ECO/108481/2008	"Evaluation of dividend barrier variables in the actuarial dual risk model"	Alfredo Duarte Egídio dos Reis	Rui Manuel Rodrigues Cardoso and Maria de Lourdes Afonso	2010-2013	21.510 € (UTL)
4. UTA_CMU/MAT/0006/2009	"Stochastic analysis and numerical approximations in mathematical finance"	Cláudia Rita Ribeiro Coelho Nunes Philippart	Gonçalo dos Reis	2011-2014	_____

6. 4. 2. Group Productivity

6. 4. 2. 1. Book

de Carvalho, V. I., Johnson, W. and **de Carvalho, M.**, *Bayesian Nonparametric Modeling of Diagnostic Data*, to appear in Chapman & Hall: CRC Statistics.

URL: http://www.amazon.co.uk/Bayesian-Nonparametric-Modeling-Diagnostic-Data/dp/1466580399/ref=cm_sw_em_r_alp_FS5Uqb0HK2MY0_tt

6. 4. 2. 2. Book Chapter

Esquivel, M. L., Mexia, J. T., da Silva, J. L. and Caeiro, F., *Advances in Regression, Survival Analysis, Extreme Values, Markov Processes and other Statistical Applications*, to appear in editors with Isabel Natário, Carlos Braumann, Springer Verlag.

URL: <http://www.springer.com/statistics/statistical+theory+and+methods/book/978-3-642-34903-4>

6. 4. 2. 3. Publications in Peer Review Journals

1. Alimi, N. A., Bink, M. C. A. M., Dieleman, J. A., Nicolai, M., Wubs, M., Heuvelink E., Magan, J. J., Voorrips, R. E., Jansen, J., **Rodrigues, P. C.**, Vercauteren, A., Vuylsteke, M., Song, Y., Glasbey, C., Barocsi, A., Lefebvre, V., Palloix, A. and Van Eeuwijk, F. A. (2012), *Genetic and QTL analyses of yield and a set of physiological traits in pepper*, *Euphytica*, 190 (2), 181-201 [Impact factor = 1.554].

URL: <http://link.springer.com/article/10.1007%2Fs10681-012-0767-0>

2. Arnold, B. C., **Coelho, C. A.** and **Marques, F. J.**, *The distribution of the product of powers of independent uniform random variables*, to appear in *Journal of Multivariate Analysis*, (special issue on Multivariate Distribution Theory in Memory of Samuel Kotz) [Impact factor = 0.879].

URL: <http://dx.doi.org/10.1016/j.jmva.2011.04.006>

3. Beirlant, J., **Caeiro, F.** and Gomes, M. I. (2012), *An overview and open research topics in statistics of univariate extremes*, *Revstat-Statistical Journal*, 10 (1), 1-31 [Impact factor = 0.125].

URL: <http://www.ine.pt/revstat/pdf/rs120101.pdf>

4. **Caeiro, F.**, Gomes, M. I. and Vandewalle, B. (2012), *Semi-parametric probability-weighted moments estimation revisited*, to appear in *Methodology and Computing in Applied Probability* [Impact factor = 0.753].

URL: <http://dx.doi.org/10.1007/s11009-012-9295-6>

5. **Cardoso, R. M. R.**, *Dividends in finite time horizon*, to appear in Applied Stochastic Models in Business and Industry [Impact factor = 0.69].
URL: <http://dx.doi.org/10.1002/asmb.1958>
6. **Coelho, C. A.** and **Marques, F. J.**, *The multi-sample block-scalar sphericity test: exact and near-exact distributions for its likelihood ratio test statistic*, to appear in Communications in Statistics-Theory and Methods [Impact factor = 0.274].
URL: <http://dx.doi.org/10.1080/03610926.2012.704542>
7. **Coelho, C. A.** and Rodrigues, A. M. (2012), *Linear Mixed Models: a Practical Guide Using Statistical Software by Brady T. West, Kathleen B. Welch and Andrzej T. Galecki*, Chapman, Hall/CRC Press (2006): a Review, Journal of Statistical Theory and Practice, 6 (3), 590-595.
URL: <http://dx.doi.org/10.1080/15598608.2012.695708>
8. **Coelho, C. A.** and **Marques, F. J.** (2012), *Near-exact distributions for the likelihood ratio test statistic to test equality of several variance-covariance matrices in elliptically contoured distributions*, Computational Statistics, 27 (4), 627-659 [Impact factor = 0.276].
URL: <http://link.springer.com/article/10.1007%2Fs00180-011-0281-1>
9. **da Silva, J. L.**, **Mexia, J. T.** and **Ramos, L.**, *On the strong consistency of ridge estimates*, to appear in Communications in Statistics-Theory and Methods [Impact factor = 0.274].
10. **de Carvalho, M.** and Ramos A. (2012), *Bivariate extreme statistics, II*, Revstat-Statistical Journal 10 (1), 83-107 [Impact factor = 0.125].
URL: <http://www.ine.pt/revstat/pdf/rs120104.pdf>
11. **de Carvalho, M.** (2012), *A generalization of the Solis-Wets method*, Journal of Statistical Planning and Inference, 142 (3), 633-644 [Impact factor = 0.716].
URL: <http://dx.doi.org/10.1016/j.jspi.2011.08.016>
12. **de Carvalho, M.**, **Fonseca, M.** and **Mexia, J. T.** (2012), *A dimension reduction technique for estimation in linear mixed models*, Journal of Statistical Computation and Simulation, 82 (2), 219-226 [Impact factor = 0.497].

URL: <http://dx.doi.org/10.1080/00949655.2011.604032>

13. **de Carvalho, M., Rodrigues, P. C.** and Rua, A. (2012), *Tracking the US business cycle with a singular spectrum analysis*, *Economics Letters*, 114 (1), 32-35 [Impact factor = 0.447].

URL: <http://dx.doi.org/10.1016/j.econlet.2011.09.007>

14. **de Carvalho, M.** and Júlio, P. (2012), *Digging out the PPP hypothesis: an integrated empirical coverage*, *Empirical Economics*, 42 (3), 713-744 [Impact factor = 0.597].

URL: <http://link.springer.com/article/10.1007%2Fs00181-010-0441-0>

15. **de Carvalho, M.** and Page, G., *Discussion of «How to find an appropriate clustering for mixed type variables with application to socio-economic stratification» by Christian Hennig and Tim F. Liao*, to appear in *Journal of the Royal Statistical Society, Ser. C*, 62 (3), 343-344 [Impact factor = 0.828].

16. **dos Reis, G.** and dos Reis, R. J. N., *A note on comonotonicity and positivity of the control components of quadratic FBSDE*, to appear in *Stochastic and Dynamics* [Impact factor = 0.746].

17. **Esquível, M. L., Mexia, J. T., da Silva, J. L.** and **Ramos, L. P. C.**, *On the rate of convergence of some asymptotic expansions and distribution approximations via an Esseen type estimate*, to appear in *Communications in Statistics-Theory and Methods* [Impact factor = 0.35].

18. **Esquível, M. L.** and **Mota, P. P.**, *On a continuous time stock price model with regime switching, delay and threshold*, to appear in *Quantitative Finance* [Impact factor = 0.735].

19. **Esquível, M. L.**, Dimas L., **Mexia, J. T.** and **Didier, P.**, *Small perturbations with large effects in Value-at-Risk*, to appear in *Discussiones Mathematicae Probability and Statistics*.

20. **Fernandes C., Ramos, P.** and **Mexia, J. T.** (2012), *Crossing balanced and stair nested designs*, *Electronic Journal of Linear Algebra*, 25, 22-48 [Impact factor = 0.563].

21. Ferreira, D., Ferreira, S. S., Nunes C., **Ramos, L.** and **Mexia, J. T.** (2012), *Approximate normality of low degree polynomials in normal independent variables*, Far East Journal of Mathematical Sciences, 68 (2), 287-296.

URL: <http://www.pphmj.com/abstract/6939.htm>

22. Ferreira, S., Ferreira, D., Nunes, C. and **Mexia, J. T.** (2012), *Estimation and crossing for models with commutative orthogonal block structure*, Advances and Applications in Statistical Sciences, 7 (2), 23-34.

23. Frei, C. and **dos Reis, G.**, *Quadratic FBSDE with generalized Burger's type nonlinearities, PDE perturbation and large deviations*, to appear in Stochastic and Dynamics [Impact factor = 0.746].

24. **Grilo, L. M.** and **Coelho, C. A.** (2012), *A family of near-exact distributions based on truncations of the exact distribution for the generalized Wilks Lambda statistic*, Communications in Statistics-Theory and Methods, 41 (13-14), 2321-2341 [Impact factor = 0.274].

URL: <http://dx.doi.org/10.1080/03610926.2011.604146>

25. **Guerreiro, G. R.**, **Mexia, J. T.** and Miguens, M. F. (2012), *Stable distributions for open populations subject to periodical reclassifications*, Journal of Statistical Theory and Practice, 6 (4), 621-635.

URL: <http://dx.doi.org/10.1080/15598608.2012.719741>

26. Inácio, V., **de Carvalho, M.** and Turkman, A. A. (2012), *Discussion of «Probabilistic index models»* by Thas, O., de Neve, J., Lieven, C. and Ottoy., J.-P. Journal of the Royal Statistical Society, Ser. B, 74 (4), 659-661 [Impact factor = 3.645].

URL: <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-9868.2011.01020.x/pdf>

27. Lima, A. T., **Rodrigues, P. C.** and Loch, J. P. (2012), *Analysis of metal ions migration to determine electro-osmotic flow for the in-situ cleanup of a tar-contaminated site*, Geoderma, 173, 119-127 [Impact factor = 2.318].

URL: <http://dx.doi.org/10.1016/j.geoderma.2011.12.026>

28. **Marques, F. J.** and **Coelho, C. A.**, *Obtaining the exact and near-exact distributions of the likelihood ratio statistic to test circular symmetry through the use of characteristic functions*, to appear in Computational Statistics [Impact factor = 0.276].

29. **Marques, F. J.** and **Coelho, C. A.** (2012), *Near-exact distributions for the likelihood ratio test statistic of the multi-sample block-matrix sphericity test*, Applied Mathematics and Computation, 219 (6), 2861-2874 [Impact factor = 1.317].

URL: <http://dx.doi.org/10.1016/j.amc.2012.08.059>

30. **Marques, F. J.** and **Coelho, C. A.** (2012), *The block sphericity test-exact and near-exact distributions for the likelihood ratio statistic*, Mathematical Methods in the Applied Sciences, 35 (4), 373-383 [Impact factor = 0.743].

URL: <http://dx.doi.org/10.1002/mma.1497>

31. **Moreira, E., Mexia, J. T.** and **Pereira, L. S.** (2012), *Clustering of loglinear models using LRT p-values to assess homogeneous regions relative to drought class transitions*, Journal of Statistical Computation and Simulation, 82 (2), 293-308 [Impact factor = 0.573].

URL: <http://dx.doi.org/10.1080/00949655.2011.640680>

32. **Moreira, E., Mexia, J. T.** and **Pereira, L. S.** (2012), *Are drought occurrence and severity aggravating? A study on SPI drought class transitions using log-linear models and ANOVA-like inference*, Hydrology Earth Systems Sciences, 16 (8), 3011-3028 [Impact factor = 3.148].

URL: <http://dx.doi.org/10.5194/hess-16-3011-2012>

33. **Moreira, E., Mexia, J. T.** and **Pereira, L. S.** (2012), *Assessing homogeneous regions relative to drought class transitions using an ANOVA-like inference, Application to Alentejo, Portugal*, Stochastic Environmental Research and Risk Assessment, 27 (1), 183-193 [Impact factor = 1.523].

URL: <http://dx.doi.org/10.1007/s00477-012-0575-z>

34. **Nunes, C., Ferreira, D., Ferreira, S.** and **Mexia, J. T.** (2012), *Control of the truncation errors for generalized F distributions*, J. Stat. Comput. Simul., 82 (2), 165-171 [Impact factor = 0.573].

URL: <http://dx.doi.org/10.1080/00949655.2011.631924>

35. **Nunes, C., Ferreira, D., Ferreira, S.** and **Mexia, J. T.** (2012), *F tests with a rare pathology*, J. Appl. Stat., 39 (3), 551-561 [Impact factor = 0.405].

URL: <http://dx.doi.org/10.1080/02664763.2011.603293>

36. Nunes, C., Ferreira, D., Ferreira, S. and **Mexia, J. T.** (2012), *Generalized F distributions with random non-centrality parameters: convolution of Gamma and Beta variables*, Far East J. Math. Sci., 62 (1), 1-14.

URL: <http://www.pphmj.com/abstract/6512.htm>

37. Pereira, D., **Rodrigues, P. C.**, Mejza, S. and **Mexia, J. T.** (2012), *A comparison between Joint Regression Analysis and the AMMI model: a case study with barley*, Journal of Statistical Computation and Simulation, 82 (2), 193-207 [Impact factor = 0.497].

URL: <http://dx.doi.org/10.1080/00949655.2011.615839>

38. Pereira, D., **Rodrigues, P. C.**, Mejza, I., Mejza, S. and **Mexia, J. T.** (2012), *Analyzing genotypes by environment interaction by curvilinear regression*, Scientia Agricola, 69 (6), 357-363 [Impact factor = 0.864].

URL: <http://dx.doi.org/10.1590/S0103-90162012000600003>

39. **Ramos, P.**, Fernandes, C. and **Mexia, J. T.** (2012), *Generalized C-restricted Kronecker product-application to balanced nested designs*, Far East Journal of Mathematical Sciences, 66 (2), 247-256.

URL: <http://www.pphmj.com/abstract/6849.htm>

40. **Ramos, L.**, **Mota, P.** and **Mexia, J. T.**, *Sample partitioning estimation for ergodic diffusions*, to appear in Communications in Statistics-Simulation and Computation [Impact factor = 0.387].

41. Roy, A. and **Fonseca, M.** (2012), *Linear models with doubly exchangeable distributed errors*, Communications in Statistics: Theory and Methods, 41 (13-14), 2545-2569 [Impact factor = 0.274].

URL: <http://dx.doi.org/10.1080/03610926.2011.609953>

6. 4. 2. 4. Other International Publications

1. **Caeiro, F.** and Gomes, M. I., *A semi-parametric estimator of a shape second order parameter*, to appear in Pacheco et al. (Eds.), Selected Papers of the Statistical Societies (SPE 2011), Springer.

2. **Caeiro, F.** and Gomes, M. I., Asymptotic comparison at optimal levels of minimum-variance reduced-bias tail index estimators, to appear in **da Silva, J. L., Caeiro, F., Natário, I.** and Braumann, C. A. (Eds.), *Advances in Regression, Survival Analysis, Extreme Values, Markov Processes and Other Statistical Applications*, Springer.

URL: <http://www.springer.com/statistics/statistical+theory+and+methods/book/978-3-642-34903-4>

3. **Caeiro, F.** and Gomes, M. I., *A class of semi-parametric probability weighted moment estimators*, to appear in Oliveira, P. E., da Graça Temido, M., Henriques, C. and Vichi, M. (Eds.), *Recent Developments in Modeling and Applications in Statistics*, Springer.

URL: <http://www.springer.com/statistics/book/978-3-642-32418-5>

4. Gomes, M. I., Henriques-Rodrigues, L. and **Caeiro, F.**, Refined estimation of a light tail: an application to environmental data, to appear in Torelli, N., Pesarin, F., Bar-Hen, A. (Eds.), *Advances in Theoretical and Applied Statistics*, Springer.

URL: <http://www.springer.com/statistics/statistical+theory+and+methods/book/978-3-642-35587-5>

6. 4. 2. 4. 1. Conference Proceedings with Peer-Review

1. **Caeiro, F.** and Gomes, M. I. (2012), *A Reduced Bias Estimator of a 'Scale' Second Order Parameter*, Proceedings of the International Conference on Numerical Analysis and Applied Mathematics 2012 (ICNAAM-2012), AIP Conf. Proc. 1479, 1114-1117.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1114_1

2. **Carvalho, F.** (2012), *Preface of the "Symposium on statistical inference in linear models"*, AIP Conf. Proc., 1479 (1), 1655.

URL: <http://dx.doi.org/10.1063/1.4756486>

3. **Carvalho, F., Mexia, J. T.** and **Covas, R.** (2012), *Commutative orthogonal block structure: orthogonal features*, AIP Conference Proceedings, 1479, 1656-1660.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1656_1

4. **Coelho, C. A** and Arnold, B. C. (2012), *Instances of the product of independent beta random variables and of the Meijer G and Fox H functions with finite representations*, AIP Conference Proceedings, 1479, 1133-1137.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1133_1

5. **Coelho, C. A.** (2012), *Preface of the "2nd Symposium on Distribution Theory, Estimation and Inference"*, AIP Conference Proceedings, 1479, 1109.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1109_1

6. **Covas, R.**, Zmyslony, R. and **Carvalho, F.** (2012), *Binary operations on Jordan algebras: an application to statistical inference in linear models*, AIP Conference Proceedings, 1479 (1), 1701.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1701_1

7. Fernandes, C. and **Ramos, P.** (2012), *Joining models with stair nesting*, AIP Conference Proceedings, 1479, 1674-1677.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1674_1

8. **Fonseca, M.**, Mathew, M. and Zmyslony, R. (2012), *Inference for the interclass correlation in familial data using small sample asymptotics*, AIP Conference Proceedings, 1479, 1704-1706.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1704_1

9. Gomes, M. I., **Caeiro, F.** and Henriques-Rodrigues, L. (2012), *PORT-PPWM extreme value index estimation*, in Colubi, A., Fokianos, K., Gonzalez-Rodriguez, G. and Kontoghiorghes, E.J. (eds.), *Proceedings of COMPSTAT 2012: 20th International Conference on Computational Statistics*, 259-270.

URL: http://www.compstat2012.org/Proceedings_COMPSTAT2012.pdf

10. **Marques, F. J.** and **Coelho, C. A.** (2012), *The multi-sample independence test*, AIP Conference Proceedings, 1479, 1129-1132.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1129_1

11. **Marques, F. J., Coelho, C. A.** and Marques, P., *The block-matrix sphericity test: exact and near-exact distributions for the test statistic*, to appear in *Recent Developments in Modeling and Applications in Statistics-Studies in Theoretical and*

Applied Statistics: selected Papers of the Statistical Societies, Oliveira, P. E., Temido, M. G. and Henriques, C. (eds.), International Book Series, Springer.

12. **Mateus, A.** and Tomé, M. (2012), *Generalized least squares method in nonlinear equations*, AIP Conference Proceedings, 1479, 1118-1120.

URL: http://proceedings.aip.org/resource/2/apcpcs/1479/1/1118_1

13. Nunes, C., Ferreira, D., Ferreira, S. S., Oliveira, M. M. and **Mexia, J. T.** (2012), *One-way random effects ANOVA: an extension to samples with random size*, AIP Conference Proceedings, 1479, 1678-1681.

URL: <http://dx.doi.org/10.1063/1.4756492>

14. **Prata Gomes, D.** and Neves, M. (2012), *Modeling Extreme Events: Sample Fraction Adaptive Choice in Parameter Estimation*, Numerical Analysis and Applied Mathematics ICNAAM 2012-AIP Conference Proceedings 1479, 1110-1113.

15. **Prata Gomes, D., Mexia, J. T.** and Neves, M., *Simulation Study of the Calibration Technique in the Extremal Index Estimation*, to appear in Studies in Theoretical and Applied Statistics, Subseries B "Selected Papers of the Statistical Societies".

16. **Ramos, P.** and Fernandes, C. (2012), *Study of the interactions in a three-way crossed classification model*, AIP Conference Proceedings, 1479, 1690-1693.

6. 4. 2. 5. Other National Publications

Coelho, C. A. (2012), *Near-exact distributions-needing them and building them*, Gaudium Sciendi, 1, 100-122, Universidade Católica Portuguesa (invited paper for the first number).

URL:http://www.ucp.pt/site/resources/documents/SCUCP/GaudiumSciendi/GaudiumSciendi_N1/Nº1_Artigos_CarlosCoelho.pdf

6. 4. 2. 6. Report

Maria de Lourdes Afonso: Scientific progress of the project PTDC/EGE-ECO/108481/2008 Evaluation of dividend barrier variables in the actuarial dual risk model, 2012.

6. 4. 2. 7. M.Sc. Theses Completed

Michał Warchoł

Smoothing Methods for Bivariate Extremes, Anthony Davison, École Polytechnique Fédérale de Lausanne and Uniwersytet Jagielloński, Lausanne, 2012.

Supervisor: **Miguel Brás de Carvalho**

Ana Margarida Alves

Provisões para Sinistros-Análise do Mercado Segurador Português, Universidade Nova de Lisboa, 2012.

Supervisors: **Maria de Lourdes Afonso** and **Gracinda Rita Guerreiro**.

6. 4. 2. 8. Ph.D. Theses Completed

Paulo Jorge Canas Rodrigues

New strategies to detect and understand genotype-by-environment interactions and QTL-by-environment interactions, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, February, 2012.

Supervisors: Stanisław Mejza and **João Tiago Mexia**.

Carla Maria Lopes da Silva Afonso dos Santos

Error-orthogonal models: Structure, Operations and Inference, Universidade da Beira Interior, November, 2012.

Supervisor: **João Tiago Mexia**

Co-supervisor: Célia Nunes.

José Moniz Fernandes

"Estudo de uma Carteira de Crédito ao Consumo de um Banco de Cabo Verde", ISEGI, Universidade Nova de Lisboa, July 2012.

Supervisors: Maria do Rosário Martins, **Manuel L. Esquível**, **Gracinda Rita Guerreiro** and Patrícia Xufre.

6. 4. 2. 9. Organization of Seminars

1. Miguel Brás de Carvalho: Invited Organizer of the session Extremes and

Applications, Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Universidade Nova de Lisboa, 23-26 July 2012.

6. 4. 2. 10. Organization of Conferences

1. Filipe Marques: Co-Chair of the Organizing Committee of the Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.

2. Francisco Carvalho: Member of the Organizing Committee of the "XIX Jornadas de Classificação e Análise de Dados" (JOCLAD2012), Tomar, Portugal, 28-31 March 2012.

3. Francisco Carvalho: Member of the Organizing Committee of the International Conference on Trends and Perspectives in Linear Statistical Inference (LINSTAT 2012) and 21st International Workshop on Matrices and Statistics (IWMS'2012), Będlewo, Polónia, 16-20 July 2012.

4. Francisco Carvalho: Organizer of the session Statistical Inference in Linear Models of ICNAAM'2012-International Conference on Numerical Analysis and Applied Mathematics, Kos, Greece, 19-25 September 2012.

5. Francisco Carvalho: Member of the Scientific Committee of the "1º Congresso de Turismo Cultural Lusófono", Tomar, Portugal, 15-16 November 2012.

6. Francisco Carvalho: Member of the Organizing Committee of the "1º Congresso de Turismo Cultural Lusófono", Tomar, Portugal, 16 November 2012.

7. Frederico Caeiro: Member of the Local Organizing Committee of the Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.

8. João Tiago Mexia: Member of the Scientific Committee of the LinStat'2012.

9. João Tiago Mexia, Manuel L. Esquível, Gracinda Guerreiro, Frederico Caeiro and José Moniz Fernandes: Members of the Organizing Committee/Scientific Committee of the "I Workshop Internacional de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, 19-20 September 2012.
10. Marta Faias: Member of the Local Organizing of the UT-Austin Portugal Summer School and Workshop in Mathematics-Mathematical Finance and Stochastic Control, Department of Mathematics of the Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, 2-13 July 2012.
11. Miguel Brás de Carvalho: Member of the Scientific Committee of the Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.
12. Paulo Canas Rodrigues: Invited Special Session Organizer-y-BIS Special Invited Session with the Editors at International Symposium on Business and Industrial Statistics ISBIS 2012, Bangkok, Thailand, 17-21 June 2012.
13. Paulo Canas Rodrigues: Member of the International Scientific Program Committee of the International Symposium on Business and Industrial Statistics ISBIS 2012, Bangkok, Thailand, 17-21 June 2012.
14. Paulo Canas Rodrigues: Invited Paper Session Organizer-High dimensional analysis at International Symposium on Business and Industrial Statistics ISBIS 2012, Bangkok, Thailand, 17-21 June 2012.
15. Paulo Canas Rodrigues: Chair of the International Scientific Program Committee of the Joint Meeting of y-BIS-International Young Business and Industrial Statisticians, and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.
16. Paulo Canas Rodrigues: Co-Chair of the Local Organizing Committee of the Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012. Final Report in <http://www.isi->

web.org/images/news/2012-Sept-ISBIS-Final%20Report_Joint%20Meeting_y-BIS+jSPE.pdf

6. 4. 3. Internationalization

(i) Talks at international conferences

1. Carlos Agra Coelho: *Instances of the Meijer G and Fox H functions and of the distribution of the product of independent beta random variables with finite representations*, Invited Speaker at the 6th Workshop on Mathematics and Computation and 3rd Portuguese-Polish Workshop on Biometry, Covilhã, Portugal, July 2012.

2. Carlos Agra Coelho: A celebration of George P. H. Styan 75th Birthday and my meetings with him and "On the distribution of linear combinations of chi-square random variables", Invited Speaker at the Special Session in honor of George P. H. Styan at the LINSTAT/IWMS 2012-International Conference on Trends and Perspectives in Linear Statistical Inference, 21st International Workshop on Matrices and Statistics, Bedlewo, Polónia, July 2012.

3. Carlos Agra Coelho: *Instances of the Product of Independent Beta Random Variables and of the Meijer G and Fox H Functions with Finite Representations*, ICNAAM 2012-International Conference on Numerical Analysis and Applied Mathematics, Kos, Greece, September 2012.

4. Dora Prata Gomes: 6th Workshop on Statistics, Mathematics and Computation and the 3rd Portuguese-Polish Workshop on Biometry in Honor of Professor Dinis Pestana, Universidade da Beira Interior, Covilhã, 3-4 July 2012.

5. Dora Prata Gomes: 8th World Conference on Probability and Statistics, Istanbul, 9-14 July 2012.

6. Dora Prata Gomes: Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.

7. Dora Prata Gomes: 10th International Conference of Numerical Analysis and Applied Mathematics ICNAAM 2012, Kos, Greece, 18-25 September 2012.

8. Dora Prata Gomes: 5th International Conference of the ERCIM Working Group on Computing, Statistics (ERCIM 2012), Oviedo, 1-3 December 2012.
9. Eugenio V. Rodríguez, Rui M. R. Cardoso and Alfredo D. Egídio dos Reis, *On the Erlang(n) dual risk model and dividends problems*, ASTIN Colloquium 2012, Mexico City, Mexico, 30 September-4 October 2012. (Presentation by Eugenio V. Rodríguez)
10. Filipe Marques: *On the product of generalized gamma random variables*, Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.
11. Filipe Marques: *The multi-sample independent test*, "I Workshop Internacional de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, 19-20 September 2012.
12. Filipe Marques: *The multi-sample independent test*, 10th International Conference of Numerical Analysis and Applied Mathematics, ICNAAM, Grécia, 19-25 September 2012.
13. Frederico Caeiro: 6th Workshop on Statistics, Mathematics and Computation, Covilhã, 4 July 2012.
14. Frederico Caeiro: Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 25 July 2012.
15. Gonçalo dos Reis: UT-Austin Portugal Workshop in Mathematical Finance and Stochastic Control, Lisbon, Portugal, 9-13 July 2012.
16. Gonçalo dos Reis: Oxford-man institute Seminar for Quant. Finance, Oxford (UK), 4 December 2012.
17. Gracinda Guerreiro: *An Open Model for Population Evolution-Application to Consumption Credit Portfolio*, Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.

18. Gracinda Guerreiro: *Sistemas de Bonus Malus: Carteira Fechada ou Carteira Aberta?*, "I Workshop de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, September 2012.
19. João Beleza Sousa, Manuel Leote Esquível and R. M. Gaspar, *Machine learning Gaussian short rate*, 7th Bachelier Finance Society World Congress 2012, Sydney, Australia.
20. João Beleza Sousa, Manuel Leote Esquível and R. M. Gaspar, *Machine Learning Gaussian Short Rate*, Invited Sessions, "I Workshop Internacional de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, 19-20 September 2012.
21. José Moniz Fernandes: *Estimation of Default Probability on a Consumption Credit Portfolio of a Cabo Verde Bank*, Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.
22. José Moniz Fernandes, Manuel Leote Esquível, Gracinda Guerreiro, M. F. Martins and P. Xufre, *Estimação do Spread de Crédito ao Consumo de um Banco de Cabo Verde*, Invited Sessions, "I Workshop Internacional de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, 19-20 September 2012.
23. Manuel Leote Esquível and Pedro Mota: *On a Continuous Time Stock Price Model with Regime Switching, Delay and Threshold*, 7th Bachelier Finance Society World Congress 2012, Sydney, Australia.
24. Manuel Leote Esquível, L. Dimas, João Tiago Mexia and P. Didier, *Pequenas Perturbações com Grandes Efeitos no Value-at-Risk*; Invited Sessions, "I Workshop Internacional de Países Lusófonos em Actuariado", Statistics and Risk Management, Cidade da Praia, Cabo Verde, 19-20 September 2012.
25. Maria de Lourdes Afonso: *Using Weighted Distributions to Model Operational Risk*, Actuarial and Financial Mathematics Conference-Brussels, Belgium, February 2012.

26. Maria de Lourdes Afonso, Rui Manuel Cardoso and Alfredo D. Egídio dos Reis, *Dividend problems in the dual risk model*, Joint Meeting of y-BIS-International Young Business and Industrial Statisticians and jSPE-Young Portuguese Statisticians, Faculdade de Ciências e Tecnologia of Universidade Nova de Lisboa, Caparica, 23-26 July 2012.

27. Marta Faias Mateus: 13th Annual Meeting of the Association for Public Economic Theory, Indiana University, Academia Sinica, Taipei, Taiwan, 10-16 June 2012.

28. Marta Faias Mateus: 6th Meeting of the Portuguese Economic Journal, Universidade do Porto, Porto, Portugal, 6-7 July 2012.

29. Miguel Brás de Carvalho: Workshop: *Half-day Workshop on Biostatistics*, CEAUL, Universidade Nova de Lisboa, 6 January 2012.

URL: <http://ceaul.fc.ul.pt/seeevent.html?id=219>

30. Miguel Brás de Carvalho: Talk: *Bayesian Nonparametric ROC Regression Modelling*, Department of Biostatistics, University of South Carolina, February 2012.

(ii) Talks at national conferences

1. Carlos Agra Coelho: *Intuição, Realidade, Análise de dados e Inferência*, Invited speaker of the plenary session of JOCLAD 2012, "XIX Jornadas de Classificação e Análise de Dados", Tomar, March 2012.

2. Maria de Lourdes Afonso: 4th Porto Meeting on Mathematics for Industry, Porto, June 2012.

6. 4. 4. Other Important Information

1. Dora Prata Gomes: Supervisor of Erasmus students – Gülsera Tamuğur e Nazlı Mercan – Department of Mathematics of Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, 5 September 2011 to 2 February 2012.

2. Marta Faias: Member of the team of the research project: *Competencia, Cooperación, Negociación y Formación de Precios*, ECO2012-38860-C02-01 financed by VI Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica, Espanha.

3. Marta Faias: Mobility grant in the scope of the Erasmus Program to give lectures and perform research activities, 18-24 March 2012, Facultad de Economía y Empresa, Universidad de Salamanca.

(i) Peer-reviewing activities

Miguel Brás de Carvalho:

Articles:

Annals of Applied Statistics;

Bernoulli;

Biometrika;

Communications in Statistics-Theory and Methods;

Computational Statistics and Data Analysis;

Extremes;

Knowledge-Based Systems;

Journal of Business Cycle Measurement and Analysis;

Journal of Statistical Computation and Simulation;

Journal of Statistical Theory and Practice;

Journal of the American Statistical Association;

Mathematics and Computers in Simulation.

Miguel Brás de Carvalho:

Books:

Palgrave Texts in Econometrics

Miguel Brás de Carvalho:

Funding:

CONYCIT-Chilean NSF

(ii) Editing (of books and journals)

1. Carlos Agra Coelho and Filipe Marques: Special Volume "Business and Industrial Statistics", to appear in Revstat-Statistical Journal.

2. Miguel Brás de Carvalho: A Collection of Surveys on Tail Event Modeling, Revstat-Statistical Journal, 10, 2012.

(iii) Own Funding

Principal Investigator: Miguel de Carvalho, Grant by: FONDECYT-Chilean NSF
Project Title: Constrained Inference Problems in Extreme Value Modeling Duration: 3
Years (Start: October, 2012) Budget: 79 858 Euros (50638000 Chilean Pesos).