



UNIVERSIDADE DE ÉVORA

CENTRE FOR RESEARCH IN MATHEMATICS AND APPLICATIONS

Postdoctoral Research Scholarship - 2 vacancies

PosDoc1/CIMA2023 and PosDoc2/CIMA2023

15 of October of 2023

A call for tenders is open for 2 Scholarship BIPD (Postdoctoral scholarship), **PosDoc1/CIMA2023 and PosDoc2/CIMA2023**, within the scope of the project Financiamento Plurianual 2020-2023 do CIMA, with reference **UIDB/04674/2020**, financed by national funds through FCT/MCTES, under the following conditions:

Scientific area: Mathematics

Admission requirements:

PhD in a Mathematics field.

Regarding the “BIPD” (postdoctoral scholarship), in terms of the requirements to be verified for their attribution (article 7 of the FCT Research Grant Regulation no. 950/2019) the need for a doctoral degree to have been obtained in the 3 years prior to the date of submission of the application to the scholarship and, in terms of its execution, the fact that it can only be renewed for a maximum period of 3 years.

Work plan - PosDoc1/CIMA2023

The study of vector, variational problems is one of the most complex chapters of Applied Analysis. This is very well-known both from the side of Mathematics themselves, and from the side of applications (for example to Mechanics).

These variational problems are associated, through their Euler-Lagrange optimality conditions, with non-linear, steady systems of PDEs. In fact, of the two known ways to tackle such differential systems, the most powerful one comes directly from variational problems. The conditions ensuring weak lower semicontinuity, for the application of the direct method to show existence of minimizers, for vector problems involve more general conditions than just plain convexity. These vector concepts of convexity are yet far from being understood.

One of the main applications of such vector, variational problems comes from non-linear Mechanics, more precisely, from hyper-elasticity where bodies are allowed to undergo large strains and large deformations. It is a fact that the internal energy densities for such material



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behavior cannot be convex, and so those new concepts of convexity (particularly polyconvexity) need to be addressed.

The indicated difficulties have a tremendous impact on numerical approximation. In particular, lack of convexity usually means lack of uniqueness of solutions (minimizers), and no guarantee that standard computational methods (steepest descent, conjugate gradient, Newton-Raphson) would converge to the desired global minimizers. Even so, the approximation of such solutions are of importance in applications. Recently, the simulation of such vector situations in hyper-elasticity has been successfully achieved, at least at the practical level, even though some numerical analysis is still lacking.

This project pretends to focus on the numerical treatment of some vector variational problems with novel methods in some selected situations such as inverse-conductivity problems, hyper-elasticity problems under a total confinement condition and incompressible hyper-elasticity.

Work Plan – PosDoc2/CIMA2023

Objectives.

The Jordan type of an Artinian algebra is an invariant that satisfies a nice semi-continuity property, which has been useful to determine irreducible components of families of Artinian Gorenstein (AG) algebras, obtaining results on the topology of such sets. This is mostly unexplored territory and a good opportunity to tackle open problems, for a postdoc with a strong background in commutative algebra.

- First two months: study the symmetric decomposition of an AG algebra, and invariants satisfying semi-continuity properties, and apply these tools to families of AG algebras with given Hilbert function.
- Next nine months: tackle open questions on Jordan type of an Artinian algebra, related to topology or not.
- Last month: write a paper to submit to a scientific journal on the findings.

Applicable legislation and regulations: The granting of the Research Scholarship will be carried out upon the signing of a contract between the University of Évora and the scholarship holder, as set in the template [former.fct.pt/apoios/Minuta_Contrato_Bolsa.docx](https://www.fct.pt/apoios/Minuta_Contrato_Bolsa.docx), pursuant to the Research Scholarship Statute (Law No. 40/2004 of August 18 and Decree-Law No. 123/2019 of August 28) and in accordance with the legislation and Regulation of Research Grants of the Foundation for Science and Technology, IP in force, regulation nº950/2019 of December 16, 2019 <https://files.dre.pt/2s/2019/12/241000000/0009100105.pdf> and other applicable rules.



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Place of work: The work will be carried out at the Centre for Research in Mathematics and Applications of the University of Évora, under the scientific supervision of Professors Luís Bandeira and Pablo Pedregal for the PosDoc1/CIMA2023 grant and Professor Pedro Correia Gonçalves Macias Marques for the PosDoc2/CIMA2023 grant.

Duration of the scholarship: The scholarship will have a duration of 6 months, starting on March of 2024. The scholarship contract may be renewed for a maximum of 12 months.

Amount of monthly maintenance allowance: The amount of the scholarship corresponds to 1741,00€, according to the table of scholarships awarded directly by FCT, I.P. in Portugal (https://www.fct.pt/wp-content/uploads/2023/02/Tabela-de-Valores-SMM_2023.pdf), payments being made monthly, by check or bank transfer.

Selection methods: The selection methods to be used will be the curriculum evaluation and an interview, with the respective valuation of

- curriculum evaluation : 60 %
- interview : 40%

Composition of the Selection Jury:

PosDoc1/CIMA2023

Presidente: Prof. Doutor Feliz Manuel Barrão Minhós
1.º Vogal – Prof. Doutor Carlos Correia Ramos
2.º Vogal – Prof. Doutor Luís Miguel Zorro Bandeira
1.º Suplente – Prof. Doutor Vladimir Alekseevitch Bushenkov
2.º Suplente – Prof. Doutor Luís Manuel Ferreira da Silva

PosDoc2/CIMA2023

Presidente: Prof. Doutor Feliz Manuel Barrão Minhós
1.º Vogal – Prof. Doutor Carlos Correia Ramos
2.º Vogal – Prof. Doutor Pedro Correia Gonçalves Macias Marques
1.º Suplente – Prof. Doutor Vladimir Alekseevitch Bushenkov
2.º Suplente – Prof. Doutor Luís Manuel Ferreira da Silva

Advertising/notification of results: The final results of the evaluation will be publicized, through an ordered list *by final grade obtained* posted in a visible and public place of the Department of Mathematics of University of Évora, being the candidate approved notified through *email*.

To ensure the right of prior hearing of interested parties, the Final Classification project will be announced by any written means to all interested parties.

After communicating the provisional list of the results of the evaluation, candidates have a period of 10 working days to express their opinion in a preliminary hearing of interested parties.



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Application deadline and submission of applications: The tender is open from 28/11/2023 to 14/12/2023 and the results of the selection will be published by 30/01/2024.

Applications must be formalized, obligatorily, by sending an application letter with the following documents: *Curriculum Vitae, certificate of qualifications, reference or recommendation letters and other supporting documents considered relevant.*

For the purposes of application, the evidence may be replaced by a declaration of honor signed by the candidate, but the failure to demonstrate that evidence, in the contracting phase, possession of the required degree on the deadline for application or the non-presentation of proof of enrollment in the study cycle or non-degree course, for scholarships with this component, imply the cancellation of the candidate's application.

Academic degrees obtained in foreign countries require registration by a Portuguese Institution in accordance with Decree-Law no. 66/2018, of August 16 and Ordinance No. 33/2019, of January 25th.

The presentation of the certificate is mandatory for the signing of the contract. More information can be obtained at: <https://www.dges.gov.pt/pt/pagina/recognition?plid=374>

Applications should be sent by e-mail, with the reference to the scholarship you are applying for, to:

Prof. Feliz Manuel Barrão Minhós
Centro de Investigação em Matemática e Aplicações
Department of Mathematics of the University of Évora
email: dircima@uevora.pt e fminhos@uevora.pt.