

*DOCTORAL INPhINIT FELLOWSHIPS PROGRAMME – INCOMING FRAME
INFORMATION CALL 2022*

PhD POSITION OFFER FORM

Position

1. Project Title/ Job Position title: **Computational Mathematics**
2. Area of Knowledge: **Physical Sciences, Mathematics and Engineering**
3. Group of disciplines: **Theoretical and Applied Mathematics, Computer Sciences**
4. Research project/ Research Group description (max. 2.000 characters)

Specific Project Theses:

- Robot Path-planning for Quality Inspection. Advisor: Michael Barton.

Efficient and highly-accurate manufacturing of curved geometries such as turbine blades, impellers, gearboxes, or other doubly-curved engine parts is a crucial objective in many industries like automotive or aeronautic, to name a few. In these rapidly evolving industries, zero-defects manufacturing is one of the key challenges and quality control/inspection is a fundamental part of the whole manufacturing pipeline. Quality inspection is typically realized by a multi-axis robot that moves and touches the manufactured workpiece at specific points and/or carries a scanning device to capture the surface of the workpiece. The path-planning, however, typically includes human intervention of so-called operator who inserts/codes the points where the workpiece needs to be inspected.

We aim at fully automatic path-planning algorithms for multi-axis (serial or parallel) robots. Given a curved object, we will design paths of the robot such that: (i) it automatically generates the robot programming, (ii) the motion is both locally and globally collision-free, and (iii) the paths minimize the time needed for the inspection. We aim to study motions of multi-axis serial and/or parallel robots and design path-planning algorithms for contact and/or scanning-based inspections of complex geometries.

In the case of camera-based inspection, we aim at automatic seeding algorithms of the inspection points such that the to-be-inspected workpiece will be fully covered by the positions of a camera within a given distance and the inspection path of the camera-carrying robot (e.g. a 7-dof serial robot KUKA) will be minimized in terms of inspection time.

Keywords: multi-axis path-planning, multi-axis serial robot, quality inspection, optimization.

5. Job position description (max. 2.000 characters)

The Ph.D. student will develop path-planning algorithms for contact-based and scanned-based quality inspection. The inspection paths will be implemented in C/C++, Matlab, or Python and tested on complex free-form geometries. The project has a strong synergy with the FET-OPEN 2018 project on Analysis, Design, And Manufacturing using Microstructures (ADAM²). Having a complex porous geometry coming from the ADAM² project, the Phd student will collaborate with the ADAM² consortium members.

The student will also collaborate with Tecalia that is currently working in flexible robotics and machine vision applications. This collaboration will additionally allow to complete the study by closing the inspection loop with a computer vision scanning head that will be installed at the end effector of the robot.

Requirements:

- Master degree (preferable in Applied Mathematics, Engineering or Computer Science). The candidate must have his/her Master Degree completed before the incorporation.
- Applicants must have demonstrated excellent capabilities in some previous research-oriented projects.

Skills:

- Good communication and interpersonal skills.
- Ability to effectively communicate and present research ideas to researchers with different background (e.g., mathematicians and engineers).
- Ability to clearly present and publish research outcomes in spoken (talks) and written (papers) form.
- Good level of spoken and written English.

Group Leader

1. Title: Prof.
2. Full name: Marco Ellero
3. Email: mellero@bcamath.org
4. Research project/ Research Group website (Url):
<http://www.bcamath.org/en/people/mbarton>
5. Website description: Website of the CM group

Additional website (optional, max. 5 websites)

- Simulation Of Wave Propagation: <http://www.bcamath.org/en/research/lines/SIWP>
- CFD Modelling And Simulation: <http://www.bcamath.org/en/research/lines/CFDMS>
- CFD Computational Technology: <http://www.bcamath.org/en/research/lines/CFDCT>

INPhINIT Offer, eligibility requirements, evaluation and selection process

Incoming:

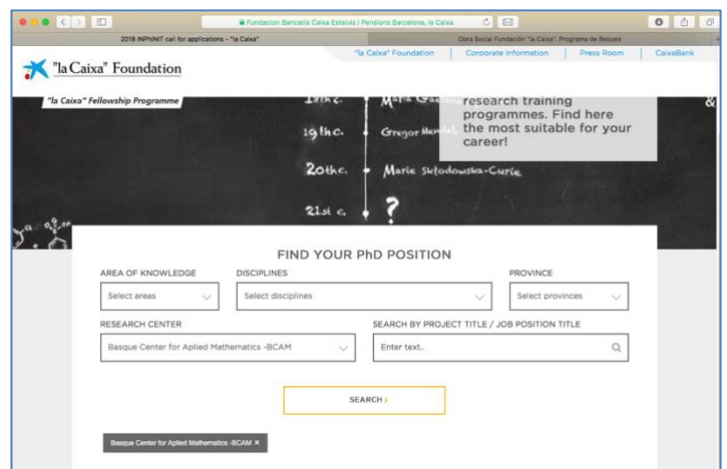
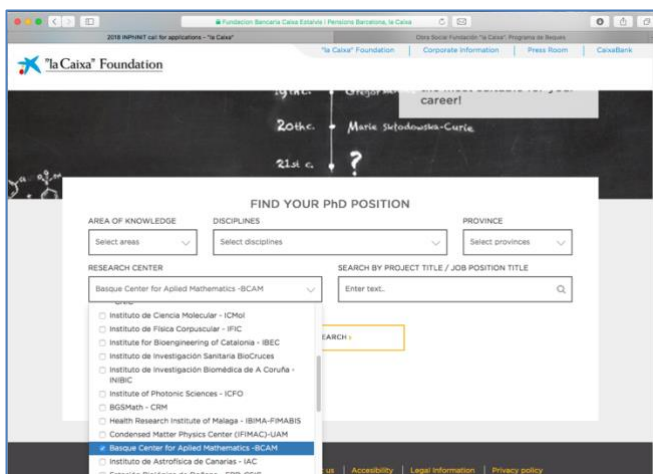
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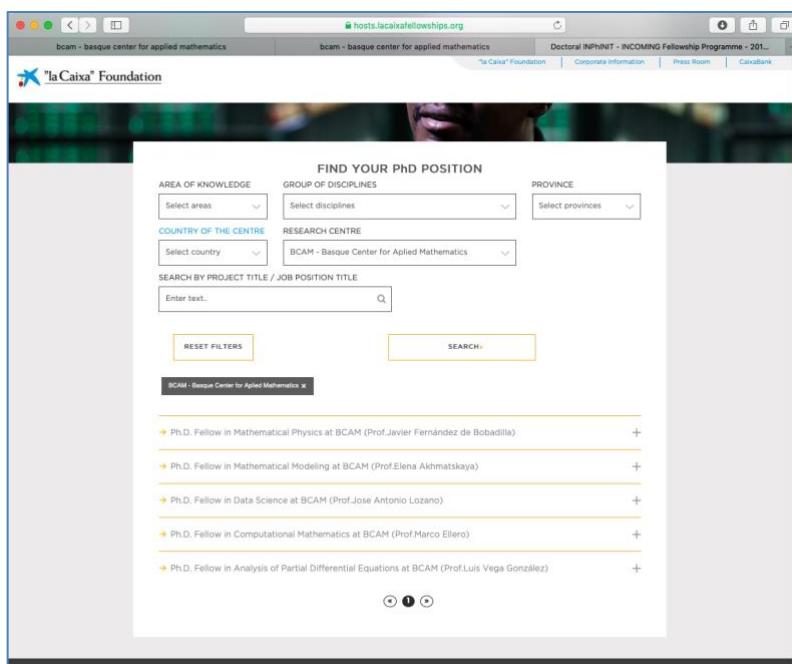
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How to Apply:

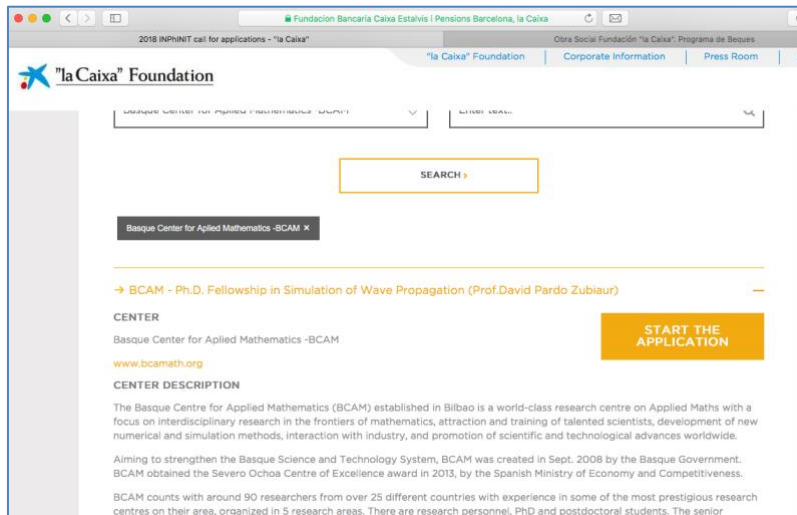
1. Click in <https://hosts.lacaixafellowships.org/finder>, click in RESEARCH CENTRE and choose "Basque Center for Applied Mathematics - BCAM"



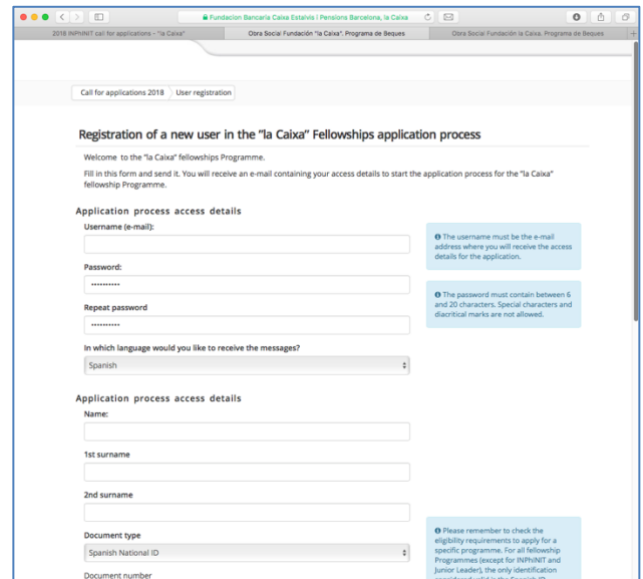
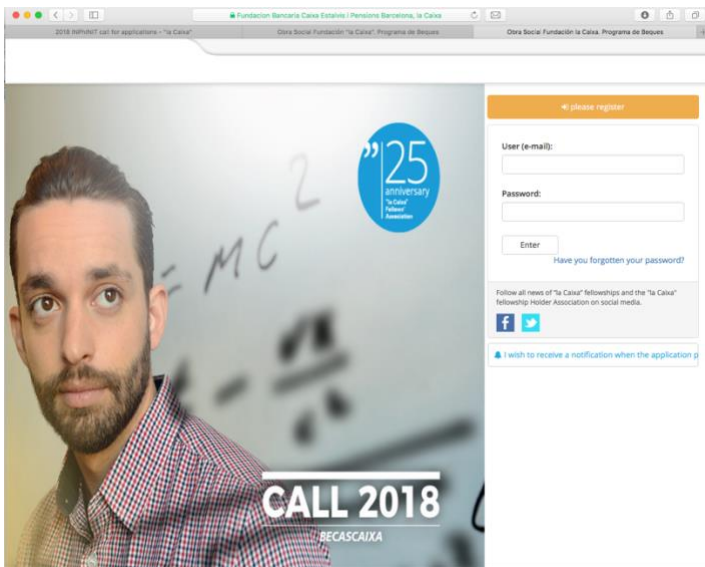
2. Click in "SEARCH" and the displayable will list the positions offered



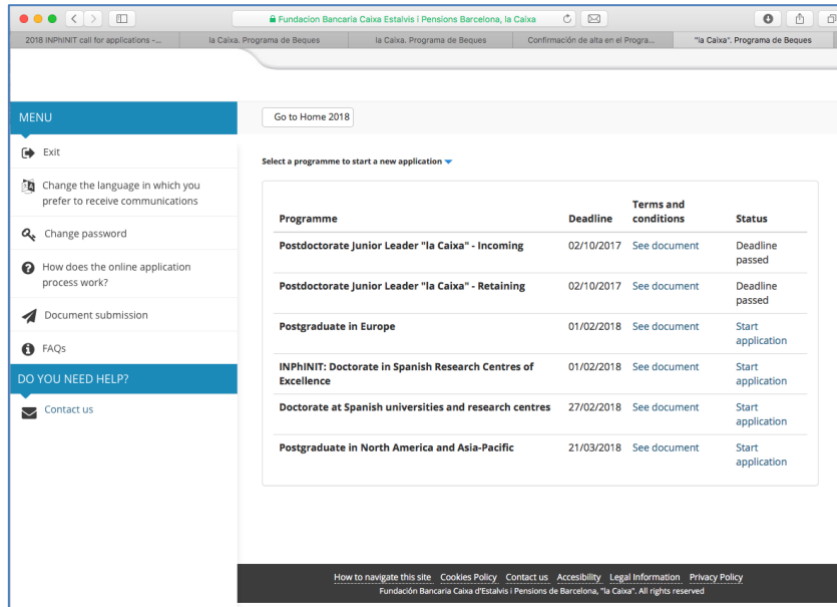
3. Click in the selected PhD Offer and click in "START THE APPLICATION"



4. The system will open a new window with the application website <https://www.lacaixafellowships.org/index.aspx>. Click in "Please register" for new applicants.



- After the registration, the system will send to you the confirmation email and the link to access into the system. Now you are in the position to access into the application system. Please choose INPhINIT: Doctorate in Spanish Research Centre of Excellence.



- Now you are in the position to fill the application form, upload the required documents and choose the project thesis. To choose the project thesis, click in "Studies to be Pursued", choose the centre and the position.

