2018-00262 - PhD Position / Numerical schemes and simulations / Image based lifetime evaluation of self-healing CMCs coupling solid mechanics and a parallel finite element simulation of the healing process in 3D crack networks [ANR VISCAP]

Contract type : Public service fixed-term contract  
Level of qualifications required : Graduate degree or equivalent  
Fonction : PhD Position  
Level of experience : Recently graduated  

Context

Host: Inria Bordeaux – Sud-Ouest, CARDAMOM research team: https://team.inria.fr/cardamom/

Within the framework of a public partnership with the French National Research Agency (ANR) : ANR VISCAP

Assignment

Assignments :

The main objective of this PhD is to develop a parallel library allowing the simulation of the lifetime of a SH-CMC, starting from 3D images (e.g. tomographs) of the material. The main milestones of the work will consist in: (i) developing a graph representation of the network of domains, using crack detection algorithms developed by the LCTS laboratory; (ii) design a method of generation of the constrained unstructured triangulations respecting the numerous interfaces present in the material (multi-layer matrix); (iii) design and implement the necessary physical pre-processing of the realistic data acquired from the image to define the computational parameters of the simulation; (iv) set up a parallel algorithm coupling all the domains in the network, as well as the crack network to the solid mechanics solver; (v) apply the resulting tool to the simulation of real materials.

For a better knowledge of the proposed research subject :

Collaboration :

The recruited person will be in connection with :

Mario RICCHIUTO : mario.ricchiuto@inria.fr  
Cécile DOBRZYNSKI : cecile.dobrzynski@math.u-bordeaux.fr  
Guillaume COUEGNAT : couegnat@cts.u-bordeaux.fr

Main activities

The key scientific contributions will be related to:
• the finite element formulation involving the coupling of 2D domains criss-crossing in the 3D network, and in particular comparing approaches involving fitting all the intersections, with cut-finite elements or other embedded methods
• the efficient hybrid parallelization of the main library as well as of the coupling with the solid mechanics solver (in house solver by LCTS)
• the application to realistic simulations and in particular to new experimental images and measurements acquired in the VISCAP project

**Interaction with the VISCAP WPs:**
Strong interactions are expected with another PhD devoted to the development of an improved PDE and FEM model of a single crack transversal to the fibers, with a simplified representation of longitudinal cracks impinging on this one. Strong interactions also with (or even partial participation to) the experimental activities related to the imaging of SH-CMCs.

**Skills**
Technical skills and level required: C/C++, FORTRAN, PYTHON
Languages: French, English
Relational skills: Team working

**Benefits package**
• Subsidised catering service
• Partially-reimbursed public transport
• Social security
• Paid leave

**Remuneration**
Fix term contract
Duration: 36 months
Gross Salary: 1982€ / month (before taxes) during the first 2 years, 2085€ / month (before taxes) during the third year

**General Information**
• **Theme/Domain**: Numerical schemes and simulations
  Scientific computing (BAP E)
• **Town/city**: Talence
• **Inria Center**: CRI Bordeaux - Sud-Ouest
• **Starting date**: 4/1/18
• **Duration of contract**: 3 years
• **Deadline to apply**: 2/25/18

**Contacts**
• **Inria Team**: CARDAMOM
• **Recruiter**: Ricchiuto Mario / mario.ricchiuto@inria.fr

**The keys to success**
The candidate will be required to have very good programming skills and familiarity with engineering and mechanical problems related to the proposal. In particular a strong background in scientific computing and in particular high level/object oriented programming (C/C++/Fortran, Python, etc). A good background in applied maths, and in particular PDE modeling, and numerical methods is also
**Conditions for application**

Thank you to send:

- updated CV
- cover letter
- letters of recommendation

Master Degree Transcripts (please include your "Transcripts" document with your cover letter or with the letters of recommendation)

**Defence Security**:  
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

**Recruitment Policy**:  
As part of its diversity policy, all Inria positions are accessible to people with disabilities.

**Warning**: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.