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 : https://team.inria.fr/cardamom/files/2011/07/VISCAP-PHD2.pdf

Collaboration :
The recruited person will be in connection with :
Mario RICCHIUTO : mario.ricchiuto@inria.fr
Cécile DOBRZYNSKI : cecile.dobrzynski@math.u-bordeaux.fr
Guillaume COUGNAT : 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

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.