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 LTC5 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: [link to 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 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 LTC5)
- 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

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

Assignment

Assignments:
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Benefits package

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- Social security
- Paid leave

Remuneration
Fix term contract

Duration: 36 months

Gross Salary: 1982€ / month (before tax) during the first 2 years, 2085€ / month (before tax) during the third year