2017-00082 - Procedural, Stochastic, and Fabricable Microstructures

Level of qualifications required: PhD or equivalent  
Function: PhD Position  
Level of experience: Recently graduated

About Inria

Inria, the French National Institute for computer science and applied mathematics, promotes “scientific excellence for technology transfer and society”. Graduates from the world’s top universities, Inria’s 2,700 employees rise to the challenges of digital sciences. With its open, agile model, Inria is able to explore original approaches with its partners in industry and academia and provide an efficient response to the multidisciplinary and application challenges of the digital transformation. Inria is the source of many innovations that add value and create jobs.

Context

This PhD position is funded by ANR JCJC 2017 MuFFin.

Assignment

Contacts

Jonás Martínez (jonas.martinez-bayona@inria.fr) and Sylvain Lefebvre (sylvain.lefebvre@inria.fr).

Team

Alice, INRIA Nancy Grand-Est.

Main activities

Context

Additive Manufacturing (AM) technologies are now capable of fabricating microstructures at the scale of microns, therefore enabling to precise control of the macroscopic physical behavior. This control empowers a wide range of industrial applications by bringing high-performance customized materials. In particular, a promising venue lies in the optimization of material properties such as rigidity or impact absorption.

Microstructures for AM will play a decisive role in the factory of the future, but several challenges remain aside [1]. The dimension of the objects being printed increases, and concurrently, the available printing resolution becomes finer. Thus, the geometry size of microstructures is drastically escalating. From a computational viewpoint, explicitly storing the microstructure geometry (e.g. in an STL file), will eventually render infeasible the whole computational pipeline (numerical simulation, visualization, and computational design of microstructures). From a material science viewpoint, it remains a challenge to properly embed and grade microstructures within an object, and to ensure that they can be directly fabricated with AM processes.

State of the art methods consider periodic microstructures [4, 5, 6], offering compact storage, efficient display, and simulation of the macroscopic physical behavior. However, due to their constrained global structure, periodic microstructures exhibit a poor grading behavior, specially when targeting anisotropic material properties that follow an arbitrary orientation field.

Project description

General Information

- Theme/Domain: Interaction and visualization  
  Scientific computing (BAP E)  
- Town/city: Villers-lès-Nancy  
- Inria Center: CRI Nancy - Grand Est  
- Starting date: 1/1/18  
- Duration of contract: 3 years  
- Deadline to apply: 1/31/18

Contacts

- Inria Team: ALICE  
- Recruiter: Martinez Bayona Jonas / jonas.martinez-bayona@inria.fr

The keys to success

Required qualifications

MSc in computer science.

How to apply

Send the following documents to jonas.martinez-bayona@inria.fr in a single ZIP file:

- CV.
- A motivation letter describing your interest in this topic.  
- Your degree certificates and transcripts for Bachelor and Master (or the last 5 years if not applicable).  
- Master thesis (or equivalent) if it is already completed, or a description of the work in progress, otherwise.  
- Publications, if any (it is not expected that you have any).

In addition, at least one recommendation letter from the person who supervises(d) your Master thesis (or research project or internship) should be sent. At most two other recommendation letters may be sent. The recommendation letter(s) should be sent directly by their author to jonas.martinez-bayona@inria.fr

Applications to be sent as soon as possible.

Conditions for application

Defence Security:
The objective of the thesis is to tackle the aforementioned interdisciplinary challenges by considering procedural, stochastic, and fabricable microstructures, with a controlled macroscopic physical behavior. We have recently contributed novel techniques in this area of research [2, 3].

The detailed description of the PhD proposal can be downloaded from [here](#).

**Skills**

**Language**

English.

**Benefits package**

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

**Remuneration**

Rémunération : 1982,00€ brut mensuel