



**LabEx MMCD**  
**Multi-Scale Modelling & Experimentation of Materials for**  
**Sustainable Construction**

**Post-doctoral position**

**Modeling of effective properties of bi-porous materials**

**Abstract**

This post-doctoral project is a part of the transverse project entitled “Bio-sourced and Sustainable Porous Materials in Civil Engineering” in the framework of the Laboratory of Excellence (LabEx) MMCD “Modeling & Experimentation for Sustainable Construction” of the “Université Paris-Est”. The three partner laboratories of this project are the “Institut de Chimie et des Matériaux Paris-Est” (ICMPE, UMR 7182 CNRS), the Laboratory NAVIER (UMR 8205 CNRS) and the laboratory “Modélisation et Simulation Multi Echelle” (MSME, UMR 8208 CNRS)

One of its objectives is to study of the multi-physical behavior of materials in development and to better understand the microstructural effects on their effective properties. The obtained results are important to guide the elaboration task of these materials, which also actively is developed by the chemists within the project framework. We will focus on determination of the effective mechanical, acoustic, thermal and hydraulic properties. The theoretical characterizations, together with experimental characterization, would provide more precise specifications for the elaboration.

The successful candidate will develop new multi-scale analysis for modeling the physical behavior of elaborated poroelastic materials, considering that at the smallest scale there are two phases: an elastic solid and fluid-saturated pores. At each scale, the effective properties will be obtained *via* the asymptotic two-scale method. The asymptotic development will also allow for obtaining the system of equations resulting from the homogenization modeling the effective response of the material at different frequency ranges of applied excitations.

The numerical solution will be obtained by using the finite element method and/or the Fast Fourier Transform method. The candidate will implement the numerical methods and provide some useable tools which allow other PhD students to do their own numerical tests.

**Keywords**

Bio-sourced materials, bi-porous, asymptotic homogenization, numerical methods

### **Required competences**

The candidate should have a PhD in solid mechanics with strong backgrounds in numerical methods for solving partial differential equations. A taste of modelling and programming is also appreciated. Knowledge of multiscale and homogenization methods using double-scaled asymptotic development methods will be a plus. The candidate is supposed to work on a transverse project with strong collaborations between specialists in mechanics and chemists. He/she should be able to participate to their discussions with certain open-mindedness.

### **Application procedure**

The application should be written in English or French. Please send your cover letter and CV (including publication list, prior research experience and contact information of two references) as a single pdf file to:

MSME :                Salah Naili ; naili@u-pec.fr  
                             Vu-Hieu Nguyen ; vu-hieu.nguyen@u-pec.fr

### **Salary, duration and location**

Net salary: about 2000€/month (gross salary: 2500€/month). The postdoctoral position is for 12 months and can start in November 2017

The laboratory is located at the "Campus Centre" (Métro Créteil-Université, about 10 km from Paris center).

### **Date of starting diffusion**

July 2017

### **Contacts**

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