Postdoctoral position

Study of enzymatic hydrolysis of biomass using numerical homogenisation

Context

The architecture of biomass is highly complex and variable depending on the species and can be defined as a continuum of spatial scales ranging from molecules to particles, including polymers, nanostructures, assemblies, cells and tissues. These scales are highly interconnected and reflect not only the heterogeneity of the chemical and structural properties of biomass, but above all its reactivity to transformation processes such as chemical, physical, mechanical or biological reactions.

The mission of this postdoctoral position is part of the FillingGaps project funded by the ANR through the Priority Research Programme and Equipment (PEPR) Biomass, Biotechnology, Technologies for Green Chemistry and Renewable Energies (B-BEST) co-led by IFPEN and INRAE. The objective is to develop multi-scale approaches for representative biomass species in order to establish relationships between scales with the aim of identifying markers of biomass properties and reactivity.

To this end, **the successful candidate, who will be a specialist in numerical methods and more specifically finite element methods, will develop a model of enzymatic hydrolysis**, one of the most widely used processes for converting lignocellulosic biomass. Approaches involving upscaling will be used, enabling work to be carried out on a scale representative of a typical biomass (e.g. maize), while taking into account small-scale structural heterogeneities. The project will mainly consist of implementing **a multiphysical dynamic model in the TUMUPSCALE numerical homogenisation code (Python language, FeniCS environment**) developed by the Porous and Biological Media group at the Toulouse Institute of Fluid Mechanics. This technique will be implemented on sets of 2D or 3D images obtained by the consortium using various imaging techniques.

Assignment from 1 December 2025 to 31 May 2027

Keywords

Biomass, reactive transport, upscaling, multiphysical phenomena, finite elements, numerical schemes, variational formulations

Required training and skills

The candidate will have a PhD in mechanics on a subject addressed using numerical approaches. He or she will be proficient in finite element modelling and writing variational formulations of PDEs. Knowledge of numerical schemes in multiphysics problems and the Python language would be an advantage.

Address of the host laboratory
Institut de Mécanique des Fluides de Toulouse, Allée du Pr Camille Soula 31400 Toulouse
https://www.imft.fr/

Contract duration
18 months

Salary
From €2,700 gross per month, depending upon experience of the person recruited.

Scientific supervisors and contacts
Paul Duru (paul.duru@imft.fr) and Pauline Assemat (pauline.assemat@imft.fr)

To apply
Send your CV and cover letter to the above contacts.