

Postdoctoral proposal

Topic: Combustion modelling in the Lattice Boltzmann Framework
M2P2 lab, Marseille. <http://www.m2p2.fr/>

Background, Context:

The industry relies increasingly on numerical simulation for designing, improving, and even validating new combustion devices (engine, burner, furnace, etc.). Today, numerical combustion modelling relies almost exclusively on numerical codes solving the Navier-Stokes equations.

The Lattice Boltzmann solvers are very different from these codes, intending to solve a discrete variant of the Boltzmann equation. This type of flow solver is progressing rapidly, however, in turbulent flows configurations. The results obtained with Lattice Boltzmann methods (LBM) have shown to be excellent for aerodynamic applications, motivating intensive development of new methods.

Lattice Boltzmann methods applied to industrial applications are recent, however, so few models are able to deal with multiphase flows, and almost none with reactive (combusting) flows.

The development of combustion modelling within the LBM framework is the topic of this study.

Research subject, work plan:

Extending the LBM capabilities to combustion requires a profound rethinking of existing methods developed within the Navier-Stokes framework.

The thermodynamic closure will first have to be extended to cope with multi-component ideal gas phase, including indeed the diffusive effects within (thermal and species diffusion). This, indeed, is a prerequisite to the second step, which will be to include the description of the kinetics responsible for combustion within the LBM framework. Serious fundamental work, as well as numerical modelling is indeed required.

The postdoc will be part of one of the leading research groups on LBM in France, and will work under the direction of P. Boivin (combustion) and P. Sagaut (LBM).

Essential skills:

Strong background in scientific computing (Fortran preferred), reactive and/or multiphase flows.

Proficiency in scientific writing.

Desired skills:

LBM, HPC

Funding is for 2 years.

Application:

Email CV, cover letter to pierre.boivin@univ-amu.fr by March 15th.

Intended Start date: October 2018.