Post-Doctoral position for 9 months, available immediately

Lattice Boltzmann methods and applications

Applicants should email a statement of interest, a CV, and a list of publications.

Practical information:

Salary: $\sim$ 2600 euros net/month,
Location: Rouen, France,
Dates: available immediately for 9 months,
Contact: ionut.danaila@univ-rouen.fr

Advisors:
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Laboratoire de mathématiques Raphaël Salem
Université de Rouen Normandie, France

Context:

This study is part of a regional research program entitled ELBA: Exploration of the Lattice Boltzmann method and Applications. This project is aimed at developing at Laboratoire de mathématiques Raphal Salem (LMRS) a new research topic focused on the Lattice Boltzmann numerical Method (LBM). Applications concern two research areas developed at LMRS: liquid-solid phase-change systems (fusion/solidification phenomena described by the Navier-Stokes-Boussinesq equations) and quantum superfluid systems (described by the Gross-Pitaevskii equation) [1].

Research topic: Solid-liquid phase change systems involving melting or freezing processes are encountered in numerous practical applications, ranging from metal casting and thermal energy storage to food freezing. Recent models include several important physical phenomena, such as gravity effects, convection in the liquid phase, the presence of a mushy region (containing both solid and liquid particles) at the interface between the two phases, etc. In recent studies [2,3] we developed a numerical system using a single-domain approach based on Navier-Stokes-Boussinesq equations. The implementation used a finite-element method with mesh adaptivity and domain decomposition based on FreeFem++.

Objectives:

We intend to develop new LBM-GPU numerical codes in collaboration with the University of Erlangen-Nürnberg, where the highly-performant library walBerla is developed and maintained. The new LBM codes will allow us to tackle, with a reasonable cost of numerical simulations, actual and timely research topics: the simulation and thermal optimization of phase-change materials, detection of marl pits in Normandy (natural convection) and the simulation of different models for the permafrost (collaboration with physics).

Requirements:

The successful candidate is expected to hold (or about to have) a PhD in the area of computational physics or applied mathematics. Programming experience is essential. Experience in using high-performance computing facilities (HPC) would be an advantage.

Bibliography (with links) :

[1] LMRS numerical group

[2] G. Sadaka, A. Rakotondrandisa, P.-H. Tournier, F. Luddens, C. Lothod and I. Danaila, Parallel finite-element codes for the simulation of two-dimensional and three-dimensional solid-liquid phase-change systems with natural convection, Computer Physics Communications, 257, p. 107492(1-26), 2020.
Dedicated web page with codes and supplemental material (movies, pictures).

[3] A. Rakotondrandisa, G. Sadaka and I. Danaila, A finite-element toolbox for the simulation of solid-liquid phase-change systems with natural convection, Computer Physics Communications, 253, p. 107188(1-20), 2020.
Dedicated web page with codes and supplemental material (movies, pictures).