**Modélisation et Simulation Multi Echelle** **MSME UMR 8208**

**Post-doc position:** Air pollution sensor design using CFD-DEM simulations.
**Location:** MSME laboratory, 77420, Champs-sur-Marne, France (https://msme.univ-gustave-eiffel.fr).
**Duration**: 12 months.
**Advisors**: Amine Chadil (MSME), Emmanuelle ALGRE (ESYCOM) and Pierre Didier (CERTES).
**Key words**: Microfluidic, Aerosol particles, CFD-DEM Simulation, OpenFOAM, Air Quality.

## Context

Suspended fine particles are a significant contributor to air pollution, both outdoors and indoors, with notable impacts on public health. Accurate measurement of these particles is essential, particularly for PM10, PM2.5, and PM1 concentrations, as well as their chemical composition. However, current technologies do not enable real-time and in situ measurement of both parameters simultaneously. While miniaturized sensors are available for measuring particle concentrations, none incorporate integrated chemical analysis.

This post-doctoral position is part of the PM-Microlab project that aims to lay the groundwork for developing innovative devices capable of simultaneously quantifying particle sizes and performing chemical analysis, such as through spectroscopic methods, all integrated on a single chip. These devices will feature microfluidic channels operating in air. To achieve this, the project will employ CFD-DEM simulations with Lagrangian particle tracking to optimize the design of these microfluidic systems. A proof of concept will be conducted on simplified devices fabricated in cleanroom environments.

## Key Objectives

The successful candidate will contribute to the following objectives:

1. Model malidation: validate a multiscale model of particle transport and dispersion using a simple device fabricated in the cleanroom facilities of ESYCOM laboratory (material: PDMS).
2. Parametric analysis: conduct a parametric analysis through CFD-DEM simulations to study the transport and dispersion of microparticles in air within a microfluidic channel. This will involve analyzing factors such as particle size, channel dimensions, flow rate, wall temperature, deposition phenomena, and sedimentation.

## Responsibilities

As a postdoctoral researcher, you will:

- Perform CFD-DEM simulations using OpenFOAM to evaluate and optimize air pollution sensor designs.
- Validate simulation results against experimental data from fabricated devices.

- Publish research findings in high-impact journals and present at international conferences.
- Collaborate with interdisciplinary teams, including experimentalists and computational scientists.

## Qualifications

Required:

- A Ph.D. in Mechanical Engineering, Fluid Mechanics, Computational Physics, or a related field.
- Expertise in CFD-DEM simulations of particulate flows.
- Proficiency in OpenFOAM and relevant computational tools.
- Strong programming skills (e.g., C++, Python).

Desired:

- Experience in particulate flows in microfluidic channels.
- Strong analytical skills and a track record of research publications.

## Application Process

Applicants are invited to submit the following documents:

- A detailed CV.
- A cover letter outlining your motivation and relevant experience.
- A list of publications.
- Contact information for two references.

Applications should be sent to Amine Chadil amine.chadil@cnrs.fr with the subject line: Postdoc Application – PM-Microlab Project.