

Job Offer

Postdoctoral position in energetics and chemical engineering

Publication date: 15/10/2019 – **Start date:** January 2020 - **Duration :** 1 year

Title:

Numerical simulation of dust cloud formation in a closed vessel.

Context:

The industrial chair ACXEME (French acronym for Ignition, Explosion, Environment and Energetic Materials) is a research program selected in June 2019 by the French National Research Agency (ANR). The chair leader is a Professor working in Bourges University Institute of Technology. This project proposes a significant contribution for the improvement of explosive and propulsive energy systems with solid fuel. Major advances will be proposed on the two following axes: optimization of materials for designed systems and prediction capacity of composition of energetic materials and system design under current and future environmental constraints. Challenges at material, energetic and system levels will be met by a consortium of industrial (MBDA France, Nexter Munitions, ASB Aerospatiale Batteries) and academic (PRISME with ICARE-CNRS Laboratories) researchers. Job offers proposed below are part of this industrial chair.

Description of the Laboratory:

PRISME Laboratory (EA 4229) is a scientific research laboratory of Orleans University and Centre-Val de Loire National Institute of Applied Sciences (INSA). Research area covers all fields of engineering sciences and it is organized in several Research Teams.

Combustion-Explosions (CE) Research Team aims at understanding phenomena leading a reactive system to ignite or explode. These phenomena are studied from hydrodynamical (overpressure, deflagration etc.) or thermal (pyrolysis, fires) points of view, but also with the improvement of adapted metrological tools. The proposed work will be supervised by Pr. M. William-Louis and Dr. S. Bernard.

Introduction:

For several years, the PRISME Laboratory and the CE Research Team are interested in risk assessment on dust explosions, where ignition and propagation of explosion are studied. So far studies are principally experimental, and we want to expand our investigation CFD tool on this way by taking into account turbulence, particle take-off, particle dispersion, rebound and sedimentation in a closed vessel.

Subject:

Bibliographic review:

A large review of previous works on multi species flow modelling or diphasic flow will be done. The candidate will research available publications on LES and turbulence intensity influence on mixture efficiency. The application field of this work is risk assessment for dust explosions.

Numerical modelling:

The candidate will have to get familiar with the multiphysics CFD-ACE software from ESI-group. He or she will develop a model in order to simulate a confined multi species and diphasic flow, where take off, drag, rebound and sedimentation of the particles are taking into account in a Eulerian model.

One of the first simulation will concern devices available in the laboratory (20 L spherical bomb and Hartmann tube) and usually used for risk assessment. Parametric studies will be done on several injectors geometry. The second case will concern the dispersion of particles in a ventilation pipe.

Validation:

Model validation will be achieved by using experimental data of the laboratory concerning concentrations measured in the 20 L bomb and the Hartmann tube.

Location:

IUT de Bourges
Laboratoire PRISME
Axe Combustion Explosions
63 avenue de Latte de Tassigny
18020 Bourges Cedex - France

Gross salary:

31500€ /year

Contact:

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Requirements:

The candidate must be holder of a PhD with a good level in CFD simulation and especially for diphasic flow. A well-known of the LES and combustion sciences will be an attractive feature.

The access to the laboratory is conditioned to security control. The candidate will have to obtain access authorisation.

To apply:

Academic CV, cover letter, recommendation letters, PhD thesis.

Bibliography:

- [1] Myriam Millogo, « Allumage combustion et explosion des poudres d'Aluminium, de Titane et de leur alliage », thèse de Doctorat, Laboratoire PRISME, Université d'Orléans, 1 Mars 2019.
- [2] V. Di Sarli & al, « CFD simulations of dust dispersion in the 20 L vessel: Effect of nominal dust concentration », Journal of Loss Prevention in the Process Industries, 27 (2014) 8-12.
- [3] V. Di Sarli & al, « CFD modeling and simulation of turbulent fluid flow and dust dispersion in the 20-L explosion vessel equipped with the perforated annular nozzle », Journal of Loss Prevention in the Process Industries, 38 (2015) 204-213.
- [4] Nicolas Cuervo & al, "Combining CFD simulations and PIV measurements to Optimize the Conditions for Dust Explosion Tests", CHEMICAL ENGINEERING TRANSACTIONS, VOL. 36, 2014.

<https://www.youtube.com/watch?v=M86zFWXlhtY&t=161s>