Internship Subject

Numerical Simulation of the Physico-Chemical Mechanisms of Interaction Between a Water Mist and a Non-Premixed Flame

Context and Objectives

In the field of fire suppression, water mists have emerged as an effective solution to limit flame propagation and reduce damage. Water mists can be employed as a curtain separating the flame from its environment to attenuate radiant heat fluxes. In this case, the degree of radiative transfer attenuation depends on the droplet density in the mist, their size, and the wavelengths of the radiation emitted by the flame. Mists can also be used to weaken reactivity to the point of extinguishing the flame. Indeed, when sprayed at sufficient velocity, large droplets can penetrate the flame, even countering the upward motion of hot gases, and under certain conditions, reach the fuel surface to alter its energy balance. Thus, the momentum of the droplets plays an essential role in the performance of a water mist. The characteristic vaporization time also plays a key role. The smaller the droplets, the stronger the thermal and compositional stratification. Additionally, the delay between ignition and water mist application is a crucial parameter for optimizing the action of a water mist system.

This internship aims to model and analyze the effect of water droplets on convective and radiative heat fluxes at the condensed fuel surface, flame structure, and unburned species using the FDS6 or FireFoam software. The primary goal is to provide general insights into the physico-chemical interaction mechanisms between the water mist and the non-premixed flame as a function of droplet size and spray velocity.

Skills Developed:

- Numerical modeling and simulation
- Reactive flow
- Heat transfer

Location: Institut Pprime, Fluide-Thermique-Combustion,
ENSMA - BP 40109, Téléport 2, 1 av Clément ADER,
86961 Futuroscope Chasseneuil Cedex

Internship Duration: 6 months with a stipend of 650 Euros per month 6 mois avec une gratification de 650 Euro par mois

Desired Profile: Master's level II or third-year engineering student

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