école doctorale **sciences pour l'ingénieur et microtechniques**

PhD title : Investigation of Single-Droplet Breakup through a gas flow
Host laboratory : DRIVE Lab (EA1859), ISAT, Nevers, France
Speciality of PhD: Fluid Mechanics
Keywords : DNS, Two-phase flow, Turbulence

Job description :

This Ph.D. position is proposed by the DRIVE lab of the University of Bourgogne Franche-Comté, located in Nevers, France. Staffed by ca. 60 community members of which ca. 30 researchers and ca. 20 PhD. students, the DRIVE laboratory develops high-level applied and fundamental research with cutting-edge equipment.

Scientific context

Understanding the droplet breakup in a gas environment is important when facing numerous challenges in diversified domains: Combustion of biofuel in aeronautical/aerospace engine towards decarbonated energy; Efficiency of medical spray or drug injection passing through human body; Elimination of virus aerosol to avoid transmission, etc.

Despite efforts in numerical and experimental approaches [1-5] with different applications, the physical mechanism is not fully understood to predict precisely how liquid breaks into ligaments and droplets (spray). This phenomenon is complex due to different scale and 3D geometry of the spray. These characteristics lead to difficulties in numerical modeling [6]. For example, one of the scenarios is to model droplet by using asymptotic geometry like sphere [7,8] for the purpose of simplification. On the other hand, optical diagnostics have been used to investigate sprays in various applications. But the uneven concentration in space and the rapid time evolution make it difficult to investigate a real-size industrial spray [16]. In addition, numerical and experimental investigations are often conducted in distant conditions, it increases the difficulty to compare both results for validation. Moreover, the breakup process highly depends on physical properties of droplet [9, 10], especially Weber numbers [11-15]. Despite the gas flow contributes highly to the liquid breakup in most applications, only few works investigate the impact of the Reynolds number of the gas flow. Moreover, efficient models for atomization processes that do not require heavy computer power still need to be developed. Instability theory has widely been used in that purpose but some interesting alternatives have more recently been addressed.

Main activites

The work envisioned is intended to deepen the knowledge on the influence of

Reynolds and Weber numbers on the droplet breakup process and propose new paths for effective models of atomization. Through direct numerical simulation (DNS) and experiments in a pressure vessel the contribution of scale-independence and optimization features will be developed in the trend of recent bibliography. The PhD candidate is expected to participate to the design of experiments and carry numerical simulations, and ultimately contribute to model development.

References :

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Candidate Profile: Master (M.Sc.) or Engineer (B.Sc.) degree in Fluid mechanics or related domains. Numerical background is preferred. Additional experimental background is appreciated. Fluent English (written and spoken) are required. French is optional.

Please provide the following documents: CV, Cover letter, Grades (Master/Engineer, undergraduate), Recommendation Letters, References and other related documents.

Financing Institution: French government scholarship / Bourse Ministère MESRI

Application deadline : 15 June 2021
Start of contract : october 2021
Duration of contract: **36 months**

Supervisor(s) :
Director : Pr Luis Le Moyne luis.le-moyne@u-bourgogne.fr
Dr Julien Jouanguy Julien.Jouanguy@u-bourgogne.fr
Dr Yujun Cao yujun.cao@u-bourgogne.fr