PhD position at the University of Orléans

in Mechanical engineering (Fluid mechanics and Energetics)

Study of Hydrogen Jet and Hydrogen-Air Mixture Preparation

Application to Spark-Ignition Engines

Europe has outlined its path for embracing its ecological transition, called the "Green Deal," by implementing a series of political initiatives. In the field of ground transportation, several technologies enable the achievement of these commitments: electric propulsion powered by batteries or fuel cells, as well as internal combustion engines running on hydrogen.

The DELHYCE industrial chair ("DEsign of Low emission and efficient Hydrogen Internal Combustion Engines"), led by the PRISME laboratory, Stellantis, and Renault Trucks, aims to create a scientific methodology for designing internal combustion engines that use hydrogen. This methodology is based on small-displacement diesel engines for commercial vehicles and larger-displacement engines for trucks. The objective is to optimize the efficiency of internal combustion engines while reducing NOx emissions, with a focus on controlling abnormal combustion characteristics typical of these engines.

Direct hydrogen injection, water injection, and their mixtures with air are key steps to ensure optimal performance in terms of reducing NOx emissions and minimizing abnormal combustion. The thesis's objective is to study the hydrogen jet in a chamber, as well as the mixture between the hydrogen jet, water injection, and air intake in engines with optical access. Various optical diagnostics will be used: Schlieren visualization, BOS, and high-speed PIV will help characterize the jet (hydrogen penetration, interaction with air, etc.), while Laser-Induced Fluorescence will quantify the mixing fraction between air and hydrogen to determine the degree of homogeneity.

The doctoral candidate will need to acquire knowledge in fluid mechanics, propose and implement a protocol, and conduct experimental tests. They will also need to familiarize themselves with optical diagnostics and develop skills in this field. The unique nature of the topic will allow the selected candidate to interact with other doctoral students from the DELHYCE industrial chair and other international laboratories.

Keywords: Hydrogen; Green combustion; Spark Ignition engine

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Doctoral School	École Doctorale EMSTU ED552 (Université d'Orléans)
Renault Trucks supervisor	Camille Hespel, camille.hespel@univ-orleans.fr
PhD location	PRISME Laboratory , Université d'Orléans, France
Duration and start date	3 years, starting in the fourth quarter of 2024
Employer	Université d'Orléans
Language requirements	Fluency in French or English
Profile	Engineering degree or Master's degree in energy, fluid mechanics, or propulsion.

To apply, please send your cover letter and CV to the supervisors indicated here above.