

## PhD position at IFP Energies nouvelles (IFPEN) in *Mechanical engineering (Fluid mechanics and Energetic)*

### Augmented Large-eddy simulations of an internal combustion engine fueled with hydrogen / Simulations LES augmentées d'un moteur à combustion interne alimenté en hydrogène

This PhD is integrated in the ANR-PRC-2020 project ALEKCIA, the main objective of which is to develop game-changing tools for augmented prediction and analysis of turbulent reactive flows. In that respect, a coupled experimental and numerical approaches in an optical access spark-ignition engine fueled with hydrogen will be carried out by the different partners (IFPEN, PRISME, PPRIME).

The first goal of the present PhD is to develop numerical methodologies enabling to perform **optimized Large-Eddy simulations (LES)** of stabilized cases and fast transients by **reducing the uncertainties** of the boundary conditions.

A second objective is to **correlate flow topology** with combustion characteristics based on as few cycles as possible in order to be usable with expensive LES and transient operating conditions. For that purpose, **decomposition methods** will be applied on the turbulent flow.

A third aim is to integrate cycle-resolved measurement data obtained in extreme cycles using **Data Assimilation technique** (developed by Pprime) in the LES in order to reproduce sporadic and transient phenomena. The detailed analysis of results will determine which key parameters are responsible for such sporadic phenomena and cyclic variability.

Taking into account the innovative nature of the work, publications in high quality scientific journals are expected.

**Keywords:** CFD, Large-eddy simulation, uncertainty and sensitivity analysis, calibration / optimization, spark ignition engine, hydrogen combustion, empirical mode decomposition

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<b>PhD location</b>	IFP Energies nouvelles, Rueil-Malmaison, France
<b>Duration and start date</b>	3 years, starting preferably on October 1, 2022
<b>Employer</b>	IFP Energies nouvelles, Rueil-Malmaison, France
<b>Academic requirements</b>	MSc Fluid mechanics and/or Energetic and / or Applied mathematics
<b>Language requirements</b>	Fluency in French or English, willingness to learn French
<b>Other requirements</b>	UQ / optimization methods, Computational fluid mechanics, programming (C/C++ and Python), interest in the field of new energy technologies

For more information or to submit an application, see [theses.ifpen.fr](http://theses.ifpen.fr) or contact the IFPEN supervisor.

#### About IFP Energies nouvelles

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IFPEN offers a stimulating research environment, with access to first in class laboratory infrastructures and computing facilities. IFPEN offers competitive salary and benefits packages. All PhD students have access to dedicated seminars and training sessions.