Ph.D. Offer:

Experimental investigation of turbulent expanding flames under Spark-Ignition engine-like conditions

Description:

PRISME is a research laboratory of the University of Orléans working on various engineering fields. Its Energy Combustion Engine department is specialized in optimizing efficiency and limiting pollutant emission of engines using an experimental and 1D modelling approach. The Ph.D. student will work on the Combustion and Fuels thematic of the department that especially focuses on the impact of conventional and new fuels:

- On the combustion in the automotive engine whether it is standard or new combustion modes (Downsizing, HCCI, LTC …)
- On the pollutant emissions.

Reducing CO_2 emissions of SI engine, which currently powers 70% of light duty vehicle worldwide, is primordial to contribute mitigating the global warning importance. For this purpose, the technology favored today by engine manufacturers is downsizing, which consists in reducing the displacement and increasing the specific power by using a turbocharger. However the fuel saving potential of up to 20%, as compared to present standard engines, offered by this technology is limited in practice due to an increased occurrence of abnormal combustions (knock and super-knock) which lead to using sub-optimal spark timings. A key measure for limiting the occurrence of abnormal combustion is to increase the EGR (Exhaust Gas Recirculation) rate from presently 5% to reach values as high as 20% and even 30%. This substantially allows reducing abnormal combustions but leads to larger cycle to cycle variability and decreased heat release rates. In order to reach such high EGR rates, complex strategies must be developed (aerodynamics, spark ignition, injection targeting and timing, chamber geometry etc…) for the design and optimization of which increasingly rely on Computational Fluid Dynamics (CFD). The ANR (Agence National de la Recherche) project called MACDIL (Moteur à Allumage Commandé à forte DILution) proposes to acquire an unprecedented understanding of combustion under intermediate (15 to 25%) and high (beyond 25%) EGR rates and under pressure and temperature conditions representative of turbocharged SI engines, and to capitalize it in the form of both LES and RANS models integrated respectively in a LES research code and in a industrial RANS code.

Tasks/Objectives:

The PhD student will perform experiments on various devices and set-up such as spherical combustion vessel using different optical diagnostics. The first part of the study will focus on experiments in a turbulent combustion vessel at various pressure, temperature, dilution conditions with a potential to improve the diagnostics currently used. For the second part, experiments will be carried on a new experimental set-up called NOSE (New One Shot Engine) which can meet pressure and temperature conditions of latest downsized engine (60 bar, 800K). Experiments will be performed in both laminar and turbulent regime using optical diagnostics such as Schlieren, Tomography, PIV, etc...

Candidate Profile:

M.Sc. in Mechanical Engineering/Energetics (University or Engineering Degree)

Strong skills in Combustion, Fluid Mechanics, Turbulence, and Thermodynamics are required.

Strong willing to develop experimental skills in the combustion field. Experimental background is preferred.

Knowledge about turbulent combustion modelling would be a plus.

Good oral and written communication skills are required to report to the various partners of the ANR project, to present in congress and write articles for scientific journals.

IT: Matlab, Office.

Conditions:

Start: September/October 2016

Duration: 3 years

Location: Orléans, France

Net Salary: 1660 € per month + opportunity for extra mission (teaching).

Contact :

Pierre Bréquigny, Pr. Christine Rousselle, Pr Fabrice Foucher

e-mails :

pierre.brequigny@univ-orleans.fr

christine.rousselle@univ-orleans.fr

fabrice.foucher@univ-orleans.fr

Laboratoire PRISME : http://www.univ-orleans.fr/prisme