

PhD position at IFP Energies nouvelles (IFPEN) in Mechanical engineering (Fluid mechanics and Energetics)

Large Eddy Simulation of hydrogen combustion in high pressure gas turbines

IFP Energies Nouvelles is seeking a motivated PhD candidate to participate in a cutting-edge research project focused on the development of a new hybrid combustion model for gas turbines. With the growing interest in hydrogen as a clean alternative to fossil fuels, this project aims to address critical challenges related to combustion stability and the reduction of NOx emissions under high-pressure conditions typical of industrial gas turbines. The candidate will work on integrating two state-of-the-art models: the Thickened Flame Model (TFM) for premixed flames and the Partially Stirred Reactor (PaSR) model, which is more suited for diffusion flames or highly diluted conditions. The main challenge will involve developing a criterion to enable a dynamic transition between these two regimes based on local combustion conditions.

The selected candidate will have the opportunity to become proficient in advanced numerical simulation techniques, including Large Eddy Simulation (LES) and Direct Numerical Simulation (DNS), and will benefit from access to high-performance computing resources. The developed model will be validated using experimental data from ONERA's high-pressure test bench. This PhD project offers a unique opportunity to explore high-impact scientific and industrial challenges related to energy efficiency, emission reduction, and computational fluid dynamics. The work will yield significant recognition through scientific publications, participation in international conferences, and collaborations within academic and industrial communities.

Keywords: Combustion, Numerical Fluid Dynamics (CFD), Hydrogen, Gas Turbines.

| | |
|--------------------------------|--|
| Academic supervisor | Dr Olivier COLIN, IFPEN, Laboratoire, ORCID : 0000-0002-8947-3490 |
| Doctoral School | École Doctorale « SMEMAG » ED579 (Université Paris Saclay) |
| Supervisors | Dr MEHL Cédric (IFPEN), cedric.mehl@ifpen.fr , ORCID : 0000-0003-2293-9281 Dr TRUFFIN Karine (IFPEN), karine.truffin@ifpen.fr , Dr PILLA Guillaume (ONERA), guillaume.pilla@onera.fr , ORCID: 0000-0002-5210-5256 |
| PhD location | IFP Energies nouvelles, Rueil-Malmaison, France |
| Duration and start date | 3 years, starting in the fourth quarter 2025 |
| Employer | IFPEN |
| Academic requirements | University Master degree involving CFD, physics and/or numerical modelling |
| Language requirements | English level B2 (CEFR); willingness to learn French |
| Other requirements | Programming skills (Python, C++) |

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

About IFP Energies nouvelles

IFP Energies nouvelles is a French public-sector research, innovation and training center. Its mission is to develop efficient, economical, clean and sustainable technologies in the fields of energy, transport and the environment. For more information, see [our WEB site](#).

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.