Hydrogen enhanced combustor stability

PhD position
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In the framework of the SCIROCCO (Simulation and Control of Renewable Combustion) program founded by ERC and starting in October 2019, we are looking for PhD candidates.

Context :

Combustors operating with lean premixed swirled flames powered by natural gas are one of the best solutions to cutoff pollutant emissions from power generation units. One drawback is their poor flexibility to fuel changes. With the increasing introduction of renewable fuel resources like hydrogen, fuel flexibility becomes an important issue in order to keep the performances and avoid dynamical problems like thermo-acoustic instabilities and flashback. Recent experiments made at IMFT, Toulouse, France, indicate that small hydrogen flowrates of the order of less than a few percent of total power, injected at specific locations in the burner, drastically alter the stabilization and dynamic stability of swirled combustors and could be used to increase the operability margins of the system.

Objective:

The general objective of the PhD program is to use hydrogen as an efficient secondary fuel to:
- Extend operability, especially in lean conditions
- Lower pollutant emissions
- Control combustion instabilities.
- Improve ignition and re-ignition capacities:

Program:

The problem will be tackled experimentally, numerically and theoretically. Experiments will be conducted on the multi-fuel test bench MIRADAS (Mitigation of Instabilities by Radially and/or Axially Directed Addition of Species) at IMFT. This test bench is fully instrumented for combustion, flow and acoustic analysis with large optical access. Simulations will be conducted in partnership with Cerfacs (http://www.cerfacs.fr/avbp7x/) with the LES fully compressible AVBP code for unsteady turbulent reacting flows. Results will be presented at international conferences and published in international peer reviewed journals.

Team :

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