Datum February 2019
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PhD position TU Delft

Hydrogen Combustion in Gas Turbines: Boundary Layer Flash Back Model and Validation

Start date: March/April 1st 2019

Introduction

Flexibility is key to supporting future energy generation. The growth in renewable solar and wind energy has emphasized the need for flexibility. Flexibility to reliably balance the load on the energy grid with the ability to rapidly adjust output while using cost effective fuels which also minimize carbon output. Gas turbines with a retrofit for hydrogen operation offer a low carbon solution to support the stability of the energy grid. This project provides a solution capturing the needs for energy storage and flexible power generation. Making use of the existing installed gas turbine base with a modest retrofit provides a compelling and cost effective solution.

A number of Dutch industrial parties in the gas turbine and power industry started a research project together with TU Delft to optimize the design of the gas turbine (GT) burner of one of the parties (OEM of gas turbine components) to be able to use 100% hydrogen in premixed mode.

Work description

The project has the objective to deliver a validated boundary layer flashback (BLF) model for an industrial gas turbine geometry. The TU Delft BLF model is an extension of the BLF model published by TU Munich. It should be integrated in CFD software for turbulent combustion. The model predictions have to be validated using data from literature and new experiments.

The tasks of the PhD student will be the following:

- Experimental measurements using the scaled GT burner to gain data on boundary layer flashback occurrence and properties
- CFD model development including implementation of BLF model in CFD software
- Validation of the developed CFD model with experiment data from the scaled GT burner and from the industrial test rig

The project will be executed in close cooperation with industrial partners.

The main supervisor and promotor for TU Delft is Professor Sikke Klein. Professor Dirk Roekaerts will be the co-promotor and will support the model development. Dr Mark Tummers will coordinate the experiments.

The PhD student will be enrolled in the TU Delft Graduate School.

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