

CFD of thermochemical conversion of green fuels in power production and propulsion systems

Background

To reduce greenhouse emissions from the combustion of fossil fuels that power the current large fleet of vehicles, ships, and airplanes, the search for green fuels is a hot topic of research and development. Green fuels are fuels produced from hydrogen and electricity from renewable sources. Green fuels include, for example, hydrogen, synthetic natural gas (SNG), green methanol, and ammonia. They are carbon-neutral when burned, emitting only the amount of CO₂ absorbed during their production. This project aims to contribute to developing green fuel-based propulsion systems for ships and power production systems by conducting a literature review and numerical analysis on the use of green fuels and possible emissions. The project's goals are (a) to gain knowledge of the current state-of-the-art production, storage, and usage of green fuels and (b) to identify their future potential and challenges in the energy sectors.

Tasks

Numerical simulations will be performed to investigate the combustion and emission process of green fuels in marine engines or gas turbine engines using Computational Fluid Dynamics (CFD). OpenFOAM and Cantera software will be used for the numerical simulation. A brief list of assignments for the MSc thesis work includes

- Literature survey
- Perform CFD simulation of different engine operations
- Report

Prerequisites

Numerical Fluid Dynamics and Heat Transfer (MMVN05) or equivalent. Students in the final year of their M.Sc. studies in mechanical engineering or engineering physics with an interest in fluid mechanics and computation. It is advantageous to have previous experience using CFD and mesh generation software and programming experience using Matlab or Python.

Industrial collaboration

The student will be able to interact with marine engine companies (MAN, Scania) and gas turbine developers (Siemens Energy).

Connection to research projects

EU ENGIMMONIA: <https://www.engimmonia.eu/>

Nordic Energy Research CAHEMA: <https://www.nordicenergy.org/project/cahema/>

Number of MSc theses

We plan to offer 1-3 thesis projects on this topic.

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