

## Masterarbeit

### Design of a modular electromechanical injection valve for a rotary hydrogen combustion engine

Betreuer\*in: Dr.-Ing. Sebastian Rieß  
Zeitpunkt: ab sofort  
Themengebiete: Wasserstoffmotor, Verbrennung,  
nachhaltige Kraftstoffe, Injektordesign,  
CFD-Simulation

HTM Hydro Technology Motors GmbH is a start-up company funded by the federal state of Rhineland-Palatinate focusing on the development of hybrid electric powertrain systems based on a hydrogen combustion engine. HTM's modular powertrain systems are designed to retrofit existing conventional commercial and industrial vehicles. These vehicles are nowadays mostly powered by diesel or CNG engines. By HTM's approach a significant amount of CO<sub>2</sub> emissions can be eliminated.

The core component of the powertrain system is a turbocharged rotary hydrogen combustion engine with a direct injection system. Since the requirements for injection systems for this special kind of engine system are not typical, there are no perfectly well-suited products on the market yet. It is therefore very interesting for HTM to become active in this field itself by proposing this topic for a master's thesis.

The goal of this thesis is the design of a modular electromechanical injection valve for a rotary hydrogen combustion engine according to the requirements provided by HTM. The thesis work should output a CAD model of the injection valve and documentation about performed CFD and/or further numerical simulations containing the injector map as defined below.

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GmbH

#### Proposed work packages / structure of the thesis:

- Research on state-of-the-art hydrogen injection systems technology and design, especially different concepts of sealing technology
- Design of a parameterizable modular injection valve by CAD according to the requirements provided by HTM, based on previous work done at the Professorship for Fluid Systems Technology (FST)
- Research of suitable third-party components such as coils and sealings
- CFD simulation of the gas flow through the injection valve and electromechanical/electromagnetic calculations (potentially simulations, if necessary) of the valve opening characteristic outputting the injector map (supplied hydrogen mass as a function of the electrical energization time and the supplied pressure at the injector inlet)

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