Term paper/master’s thesis

**Wall modeling of reacting turbulent flow**
(theoretical/simulative)

Liquid Rocket Engines (LRE) face extreme thermal conditions during the operation time, such as high combustion temperatures up to 3600 K combined with a high combustion chamber pressure up to 20 MPa. The prediction of heat transfer at the combustion chamber wall is crucial for performance as well as for safety reasons. In order to study unsteady turbulent combustion within LRE, LES simulations are a helpful tool. For an accurate prediction of wall heat fluxes the boundary layer must be resolved, which leads to high computational cost. Modeling the near wall area using wall models can alleviate this cost.

Our in-house code CATUM, which solves the compressible Navier-Stokes equations using a LES approach is coupled with a wall model based on turbulent boundary layer equations. The wall model must be extended in order to take chemical reactions into account, using combustion models which can be found in literature. These available models for reacting boundary layers are based on several modeling parameters and assumptions, which must be validated and improved during the work.

The work comprises the following steps:
- Familiarization with in-house code CATUM
- Extending the existing wall model for reacting boundary layers
- Validation by running 2D and 3D simulations.
- Improvement and development of wall model
- Performance analysis

The final report should be written in English.

Start: from now on.

Requirements:
- Ability to work independently
- Basic knowledge of numerical flow simulation
- Good knowledge of thermodynamics and gasdynamics
- Basic knowledge of Fortran
- Knowledge of linux advantageous

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