Universität Stuttgart
INSTITUT FÜR THERMODYNAMIK DER LUFT- UND RAUMFAHRT
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Master's thesis:
Benchmarking turbulence models for gas-turbine applications

The design of the internal cooling system of gas turbine blades (Fig. 1) demands the accurate prediction of the turbulent flow and the convective heat transfer processes. Numerous advanced models for turbulent momentum and energy transport are available, but these are rarely tested in real-world applications. The central objective of this thesis is to use some of these advanced models to obtain predictions for actual internal gas turbine cooling system. Two test cases will be considered: a two-pass cooling channel with ribs and bends (Fig. 2), and an array of jets impinging on a curved surface.

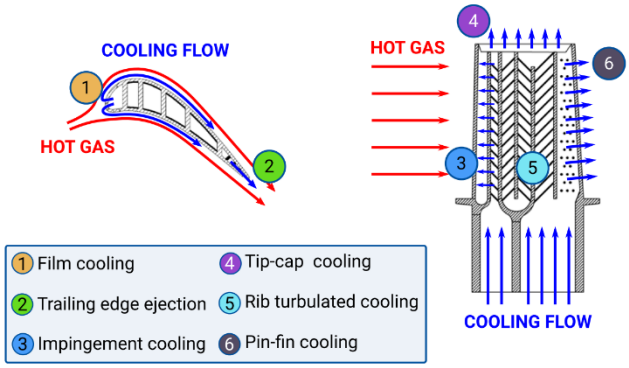

Fig. 1: Cooling technologies for gas turbine blades [1]

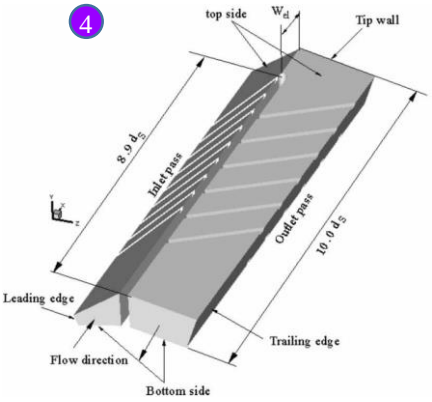

Fig. 2: Two-pass cooling channel [2]

Tasks

- Literature review
- Assessment of various turbulence model to predict the flow field in the test cases
- Assessment of various turbulent scalar-flux model
- Determination of the best combination of models for each test case
- Documentation

Place of work:
This work can be performed at ITLR or at the University of California, Davis - USA.

Begin date and duration: April 2024 (negotiable), 6 months

For more information, please get in touch with:

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[1] C. Sotgiu, B. Weigand, Towards a scalar flux model based on tensor representation theory and machine learning, DECHEMA Jahrestreffen der ProcessNet-Fachgruppen MPH, WSUE, CFD, HTT, AuW, KRI, PMT, Bremen, Germany, 2018
[2] M. Schüler, H.M. Dreher, S.O. Neumann, B. Weigand, Numerical Predictions of the Effect of Rotation on Fluid Flow and Heat Transfer in an Engine-Similar Two-Pass Internal Cooling Channel With Smooth and Ribbed Walls, J. Turbomach. 134, 2011