Shape Optimization of Turbulators in GT Blade Internal Cooling Channels

General Information

Laboratory: Laboratory for Applied Mechanical Design (LAMD)
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Objective

Effective cooling of gas turbine blades through design and optimization of the turbulators in the blade's internal cooling channel to enhance heat transfer while minimizing pressure drop

Project Phases

The project has three main tasks that need to be accomplished in collaboration with the mentor.

Parametric Geometry Design

- Utilize CAD software such as Ansys Spaceclaim or CATIA to design an exhaustive parametric geometry for the turbulators.
- Implement splines, NURBS or related components to create a flexible geometry that can be easily modified during the optimization process.

CFD Analysis

- Perform Computational Fluid Dynamics (CFD) simulations using ANSYS CFX.
- Evaluate the heat transfer coefficient, pressure drop, and other relevant parameters to assess the performance of different turbulator configurations.
- Utilize already existing CFD data for validation and comparison with optimized designs.
- Conduct sensitivity analyses to identify the most influential geometric parameters affecting cooling efficiency

Optimization

- Define objective functions related to heat transfer enhancement and pressure drop reduction.
- Employ evolutionary algorithm using Ansys optiSLang to search for the optimal turbulator geometry.
- Iterate through the optimization process to converge towards the optimal design solution.

Deliverables

- Parametric CAD model of the turbulator geometry
- CFD simulation results for baseline and optimized designs, including heat transfer and pressure drop characteristics
- Detailed report documenting the design process, simulation methodology, optimization results, and conclusions
- Presentation summarizing key findings and recommendations for future research.