

Design of a pressure sensitive paint (PSP) calibration and testing setup

The Institute of Thermal Turbomachinery and Machine Dynamics has over 20 years of experience in wind tunnel and turbine testing for civilian aero engines. With growing challenges in reducing environmental impact, our research focuses on innovative geometries to achieve lower emissions. Precise and spatially resolved pressure measurements are essential for these advancements.

Pressure sensitive paint (PSP) is an optical measurement technique used to visualize and quantify surface pressure distributions on aerodynamic models. It involves coating a surface with luminescent paint that emits light when exposed to a specific wavelength. The intensity of the emitted light changes based on local oxygen concentration, which correlates with surface pressure variations.

Additionally, PSP can be used to measure film cooling effectiveness by exploiting the analogy between heat and mass transfer. This allows the calculation of film cooling effectiveness based on the oxygen concentrations in the main flow and the coolant.

The master thesis will see the first application of pressure sensitive paint for pressure and film cooling effectiveness measurements at the Institute of Thermal Turbomachinery and Machine Dynamics.

Tasks

The master's thesis will involve the following:

- Design of a testing setup: a testing setup, including a calibration device, needs to be integrated into the high-speed wind tunnel of the Institute of Thermal Turbomachinery and Machine Dynamics.
- First experiments on the newly designed setup
- Data Analysis: development of postprocessing routines to evaluate the PSP data

This project provides an excellent opportunity to gain hands-on experience with advanced optical measurement techniques and experimental research, contributing directly to cutting-edge aerodynamic studies.

More information is available in a personal discussion, if interested.

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