Infrared Thermography to Study Endwall Cooling and Heat Transfer in Turbine Stator Vane Passages Using the Auxiliary Wall Method.

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Abstract

Experiments using the auxiliary wall method and infrared thermography allow to study film cooling and heat transfer in turbomachinery research with high spatial resolution. Using heater foils and pulse width modulation, an aluminum body is heated to constant wall temperature, controlled by thermocouples. The heat flux is then determined across a low conductivity layer of Ethylene-Tetra-Flour-Ethylene (ETFE), whereby 1-D conduction is assumed. Setting the base body to several quasi-steady wall temperatures allows to deduce adiabatic wall temperatures and heat transfer coefficients. Given a coolant and main flow with different temperature, cooling effectiveness can be calculated, using a superposition approach.

Experiments in the linear cascade test rig of the Institute for Gas Turbines and Aerospace Propulsion have been performed to study the effect of hub side coolant injection on the endwall heat transfer of a turbine stator row. The quality of results is examined through extensive data analysis, accompanied by a numerical simulation of the experiment.

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