

Abstract

Aerothermodynamic turbine tests at DLR

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In Göttingen, DLR operates a globally unique turbine test facility (NG-Turb) that enables in-depth investigations of aeroengine and stationary gas turbines under realistic conditions. In addition to testing turbines, the facility also enables the consideration of boundary conditions such as those given by the distorted outflow of a combustion chamber. Through research collaborations, aeroengine turbines as well as turbines for power generation are addressed. The aim is both to develop an understanding of the physical phenomena in the turbine and to advance the further development of numerical models. The facility, which is operated in a closed circuit, allows operation at moderate turbine inlet temperatures below 300°C while maintaining realistic Mach and Reynolds numbers. This makes it possible to use extensive measurement techniques to characterize the flow conditions in the turbine rig. NG-Turb supports research on turbine cooling strategies by ensuring a realistic temperature ratio between cooling air and main flow. In addition to the capabilities of the test facility, the lecture will also discuss the measurement techniques used to determine the flow variables. Some of these measuring techniques are calibrated in-house in the ranges relevant for the integrated test rigs, using a wind tunnel specially dedicated to calibration. The capabilities of the turbine test facility are illustrated using measurement results obtained in co-operation with Rolls Royce and Siemens Energy. Selected measurements on an aero engine turbine rig as well as on a stationary gas turbine rig show the results achieved, demonstrating the remarkable measurement accuracy and offering valuable insights for future turbine development.