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INFORMATION

GAS TURBINE RESEARCH

Internal Aerodynamics – Turbomachinery Fluid Dynamics

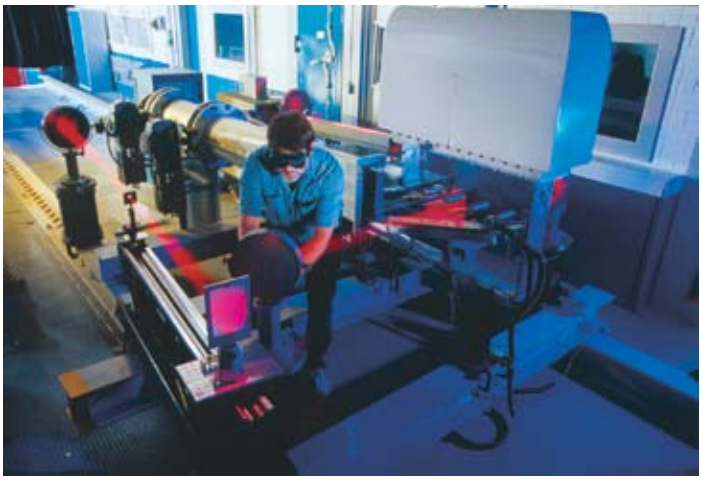
Years of research experience and client service stand behind the Gas Turbine Laboratory (GTL) staff at the NRC Institute for Aerospace Research (NRC Aerospace). The work carried out by its aerodynamics and combustion program focuses mainly on the experimental investigation of steady and unsteady flows, and heat transfer, in gas turbine engines. Its expert team serves gas turbine industry needs for testing turbine and compressor designs in the Institute's large-scale test and development facilities.

Superior facilities and support

NRC Aerospace offers a large-scale transonic planar cascade and a large-scale subsonic linear cascade capable of handling most aircraft and land-based gas turbines. Flow quality in the transonic planar cascade is so good that it has been used as the basis for the design of other industrial test cascades. Our support facilities include a high-subsonic and a low-subsonic probe calibration rig. Designed for quick and easy operation, these test facilities can accommodate a wide range of test assignments in a minimum of time and at reasonable rates.

The GTL management system has been registered to ISO 9001:2000

There is much more to our service than reliable testing and data acquisition. NRC Aerospace designs experiments from beginning to end, always with your needs in mind. We design and build models to the most critical tolerances. We also provide fast and accurate computational solutions for analysis and design problems.



Schlieren system on large-scale transonic planar cascade

Quality first

NRC Aerospace researchers are continuously developing and advancing testing techniques for the benefit of clients looking for imaginative and economical design solutions. We deliver responsive and high-quality services that meet many research challenges. We would be pleased to discuss your turbine and compressor testing and analysis needs at any time.

What we have to offer

Large-Scale Transonic Planar Cascade

This rig is a continuous flow, suction-type facility used to study the steady and unsteady aerodynamics and heat

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transfer of transonic turbine vanes. Vane span is 11.3 cm, and vane chord is typically 17.5 cm for a cascade with 6 blades. The inlet air is drawn into the cascade at a maximum flow rate of 5 kg/s. The isentropic exit Mach number can be varied between Mach numbers of 0.3 and 1.35. Data obtained include surface static pressure, quasi-wall shear stress, flow-field pressure (time-resolved and time-averaged), angle, and total temperature distributions.

High-Subsonic Probe Calibration Rig

This cold flow, suction-type rig has a large (15.25 cm) square test section and is capable of delivering uniform flow between freestream Mach numbers of 0.15 and 1. The ambient air is drawn into the test section through a contraction. The inner sidewalls of the test section are porous, which enables operation at high-subsonic and sonic conditions with high blockage tolerances. Probes are calibrated for pressure and temperature recovery at about 9 cm downstream of the throat, where the static pressure is fairly uniform. Probes are mounted on a two-degrees-of-freedom traverse mechanism on one side of the tunnel. The air flows through a diffuser downstream of the test section, before entering the pipes leading to the compressor.

Large-Scale Subsonic Linear Cascade

This is an open-circuit linear cascade wind tunnel used to study the steady and unsteady aerodynamics of turbine and compressor airfoils, at design and off-design incidence. The air flow is supplied by a radial blower at a maximum flow rate of about 5 kg/s at a total pressure rise of about 1.8 KPa. Good flow uniformity and reduced turbulence length scale are achieved by five evenly-spaced fine screens in the wide-angle diffuser and four fine screens in the settling chamber. After the settling chamber, the nearly stagnant flow is smoothly accelerated through a 14:1 contraction before entering the test-section. The flow is essentially incompressible and the wind tunnel is capable of maintaining stable velocities from 3 m/s to 30 m/s at the inlet of the cascade. The test section has a span of 20 cm and airfoil chord is typically 7.5 cm for a cascade with 9 blades.

Low-Subsonic Probe Calibration Rig

Pressure and hot-wire probes are calibrated in the large chamber of this suction-type rig. The ambient air is drawn into the chamber through a settling chamber with 6 screens, before entering the 16:1 axisymmetric contraction. Contraction exit velocity can be varied between 1 m/s and 60 m/s at a low freestream turbulence intensity of 0.3%. The probe stem is secured on the arm of a motorized two-axis turn-table mechanism, which provides variation in the pitch and the yaw angles without changing the absolute position of the probe tip. The traversing mechanisms provide ±90° probe rotations with an estimated accuracy of ±0.01°.

Measuring equipment

Available experimental techniques includes temperature and multi-hole pressure probe measurements, multi-wire hot-wire and surface-mounted hot-film measurements, laser velocimetry, schlieren flow visualization, particle image velocimetry, surface temperature measurement with liquid crystals, and surface pressure measurement with pressure sensitive paint. Data acquisition and control systems are mainly developed by internal staff.

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