STRUCTURES TESTING SUBDIVISION

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Structural Tests

Static and fatigue tests:
- static and fatigue tests of complete structures or components,
- functional tests of unloaded and loaded structures including load, displacement and strain measurements,
- stiffness evaluation,
- static and quasistatic tests of turboengine shafts or other axially symetric structures (tension/torsion loads), also at elevated temperatures,
- testing of composite structures.

Dynamic tests:
- high-cycle resonance fatigue tests and vibration resistance tests (e.g. of turbine blades),
- impact hammer modal tests of structural elements.

Other tests:
- low-revolution wear testing of fan blades and discs - test rig "Windmill",
- high-energy impact tests of structures using an air gun (diameter of projectiles up to 220 mm, weight - up to 15 kg, velocity - up to 300 m/s) with high speed camera recording and strain measurement,

The Laboratory conducts tests according to test programs designed by the client as well as providing comprehensive testing services which include:
- developing test programs including defining:
  - test objectives,
  - test specimens,
  - test load spectrum (levels, frequency, number of cycles),
  - calibration of strain gauges,
  - load control mode,
  - inspection methods and intervals,
  - procedures for the evaluation and presentation of test results,
- design and manufacturing of test rigs,
- assembly and installation of test rigs and tested objects,
- test instrumentation (strain gauges, displacement transducers),
- calibration of strain gauges,
- test execution,
- test report preparation,
- analysis of test results.

Multichannel test

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Schenck-Pegasus - High Load Tension/Torsion Electrohydraulic Testing Machine

Test type	Objects and elements tested	Basic parameters and load range	Test temperature	Equipment
Static and fatigue tests of aircraft engine shafts or other axisymmetric elements	Length: up to 3.6 m Diameter: up to 1.2 m	Axial force: up to 1334 kN Torsion: up to 452 kNm Frequency: up to 1 Hz	Up to 500°C (in tested area)	Test machine Schenck-Pegasus for simultaneous torsion and tension or compression loads
Static and fatigue tests according to individual requirements specified by the customer (including design and manufacturing of test rig). Functional tests of structures' mechanisms. Stiffness evaluation	Objects up to: 20 m x10 m	Forces: up to 200 kN Displacements: up to 1000 mm Strain: up to 60000 µm/m Frequency: up to 50 Hz	Ambient temperature (possible local heating of the structure)	24 channel electro-hydraulic test system Edyz/MTS with MTS Aero 90 controller 3 single channel load frames (MTS), with controllers
High cycle resonance fatigue tests and vibration resistance tests	Turbine and compressor blades and other elements	Frequency: up to 5000 Hz Force: up to 1350 kG. Acceleration: up to 120 g	Ambient temperature	2 electrodynamic shakers with control and data acquisition systems
Low cycle strength and fatigue tests of aircraft engines elements	E.g. fuel tubes (straight or bended) with diameter: up to 40 mm and other elements	Deflections: up to 200 mm Force: up to 10 kN Frequency: up to 6 Hz	Up to 200°C	3 single channel load frames (MTS) with controllers
Low-revolution wear testing of fan blades and discs of aircraft engines	A set of fan blades mounted on the disc Diameter: up to 3 m	Rotational speed: up to 50 rpm	Ambient temperature	Special test rig - Windmill

Operational tests

Strain gauge measurements:
- strain gauge measurements of flight loads,
- stress and strain measurements in constructions, facilities, machines, etc,
- load, strength and fatigue analysis.

Equipment:

Real-Time Controller NI CompactRIO-9022:
- embedded controller runing LabVIEW Real-Time for deterministic control, data logging, and analysis,
- 533 MHz processor, 2 GB nonvolatile storage, 256 MB DDR2 memory,
- Dual Ethernet ports with embedded Web and file servers for remote user interfacing,
- Hi-Speed USB host port for connection to USB flash and memory devices,
- Rs232 serial port for connection to peripherals; dual 9 to 35 VDC supply inputs, -20°C to 55°C operating temperature range.

Simultaneous Bridge Module NI 9237:
- 24-bit resolution, ±25 mV/V analog inputs with RJ50 connectors,
- 4 simultaneously sampled analog inputs; 50 kS/s maximum sampling rate,
- programmable half- and full-bridge completion; up to 10 V internal excitation,
- smart-sensor (TEDS) compatible,
- 1.000 Vrms transient isolation,
- -40°C to 70°C operating range.
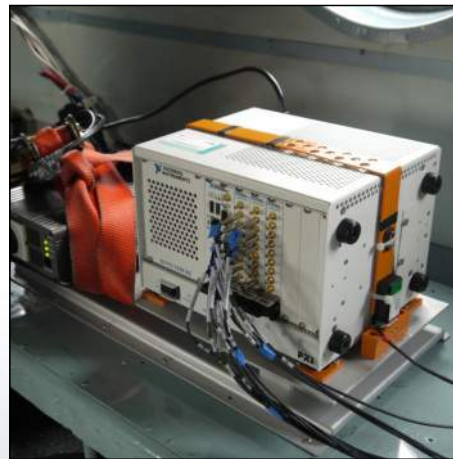
Vibration measurements and analysis:
- flight vibration measurements,
- vibration measurements of vehicles, floating objects,
- laboratory measurements of vibration,
- vibration measurements of civil engineering constructions,
- vibration measurements of working machines, rotating equipment, installations,
- vibration analysis,
- vibro-acoustic analysis,
- vibration isolation of machines and equipment,
- vibroacoustic diagnostic.

Equipment:
- 24 simultaneously sampled vibration-optimized analog inputs at up to 102.4 kS/s,
- frequency range: ~0,5 Hz - 10 kHz,
- measured acceleration range: +/-50 g,
- 0°C to 50°C operating range,
- AC/DC power supply.

Noise measurements:
- environmental noise measurements,
- aircraft noise measurements (inside and outside the aircraft),
- noise measurements of machinery and equipment,
- traffic noise measurements.

Objectives:
- assessment of the level of noise and its environmental impact,
- reduction of noise.

Design and Analysis Services

The range of services includes:
- analysis of isotropic and composite structures (including aircraft structures, windshields and others) subjected to foreign object impact with the use of LS - DYNA, including bird strike simulations (ALE and SPH methods),
- fatigue analysis of aircraft structures, including load spectra development (based on the in-service load measurement),
- developing test specifications for static and fatigue tests of aircraft structures.
- crack propagation analysis of metallic structures (2D & 3D) with the Finite Element and Boundary Element Methods (ANSYS 10, FRANC2D, FRANC3D, AFGROW, NASGRO),
- designing test rigs for the purposes of the Structural Testing Laboratory including strength analysis with the use of the Finite Element Method,
- static Finite Element Analysis (linear, nonlinear),
- comprehensive research services, from test rig design and coordination of test rig manufacturing conducted by approved subcontractors to the final test report.

Software used for analysis:
- LS-DYNA,
- ANSYS,
- FRANC2D and 3D,
- AFGROW,
- NASGRO,
- MSC PATRAN/NASTRAN,
- MSC MARC.
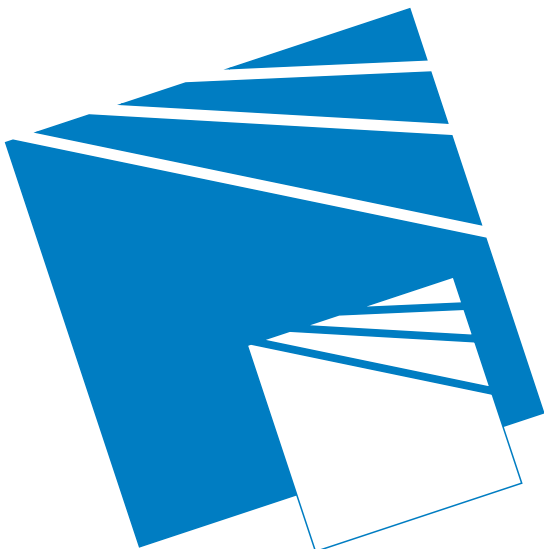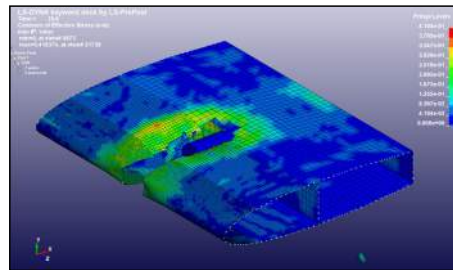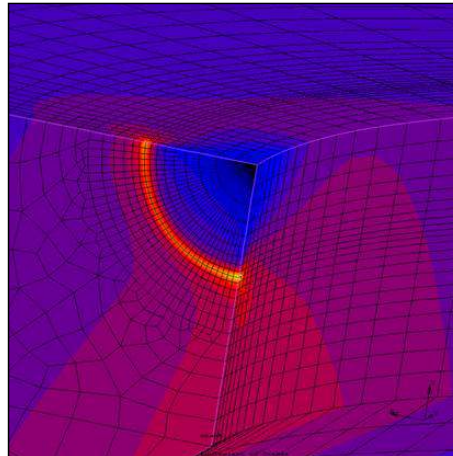
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