Institute of Turbomachinery
Technical University of Lodz

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The most important laboratory equipment:

- **electric power installed** 2.5 MW (6 kV) and 1 MW (380 V),
- **CLARK air compressor**, the flow of 7.1 kg/s at the compression ratio 2.5,
- **wind tunnel for investigations of turbomachinery blade profiles** up to 0.5 Mach number,
- **wind tunnel for automatic calibration of velocity probes** in the steady and unsteady flow up to 0.5 Mach number,
- **system for automatic measurements** of velocity, pressure and temperature fields in the steady and unsteady flow in turbomachines,
- **test stand for automatic calibration** of electric pressure transducers,
- **anechoic chamber** (dimensions: 7.5 x 13.5 x 5.5 m) for aeroacoustic investigations of turbomachine stages, with a free air flow;
- set of **test stands of active magnetic bearings**, including test stands for active control of rotating shaft vibrations;

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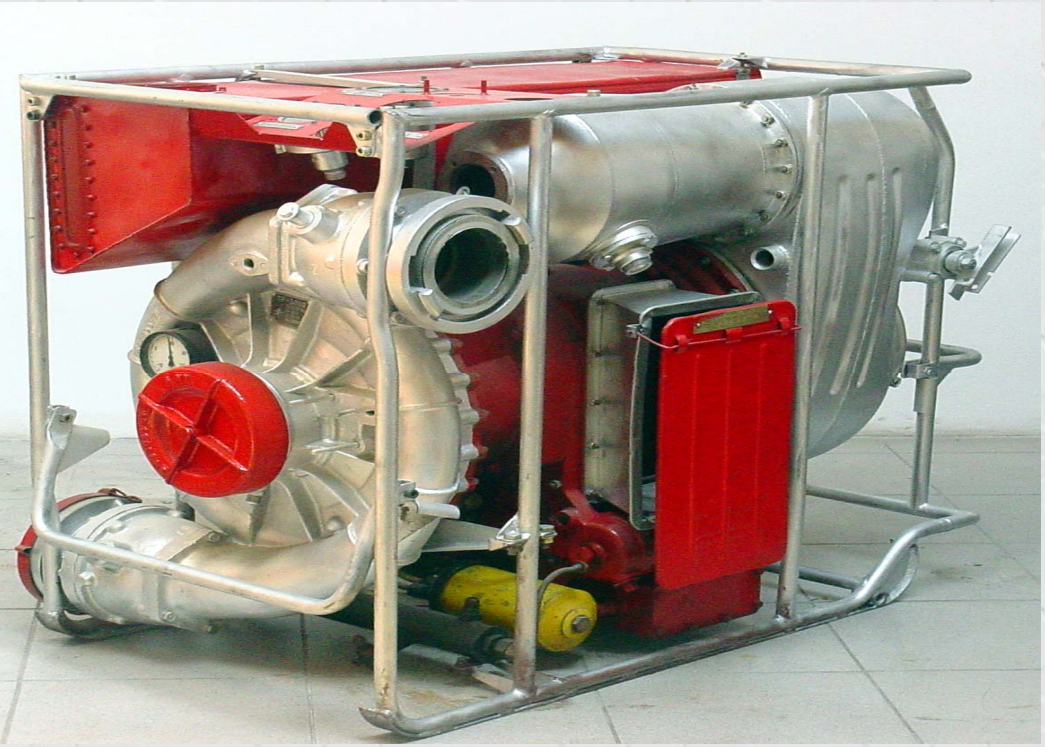
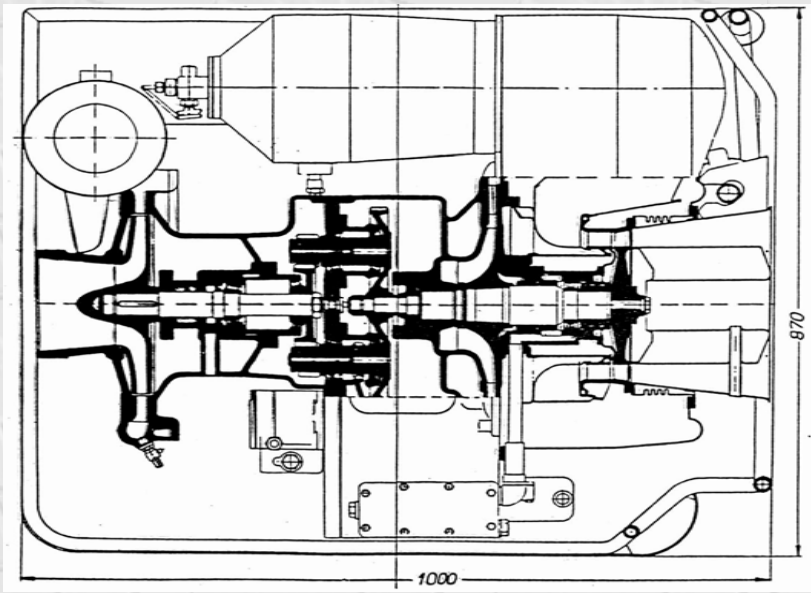
- set of **test stands** of turbomachines equipped with unconventional gas and magnetic bearing systems;
- set of **test stands of gas bearings**, including variable-geometry and ambient gas-lubricated bearings and absolute gas seals;
- **ADRE diagnostic system** for advanced analysis of vibrations in rotating systems of turbomachinery;
- **LMS Pimento** data Acquisition and Analysis System;
- **Brüel&Kjaer apparatus** for the measurement and analysis of machine mechanical vibrations with the LMS CADA PC professional software for the modal analysis;
- **Brüel&Kjaer apparatus** for acoustic tests;
- **test stand for automatic calibration** of pressure transducers;
- **apparatus for the analysis of diameters of atomized liquid drops** in the range from 0.5 to 3,000 μm, of the maximum counting speed 10,000 drops/sec.

Examples of our activities





TP 3100 turbopump with a CMP 509 gas turbine – developed by WSK Rzeszów and the Institute of Turbomachinery, TUL (1965)

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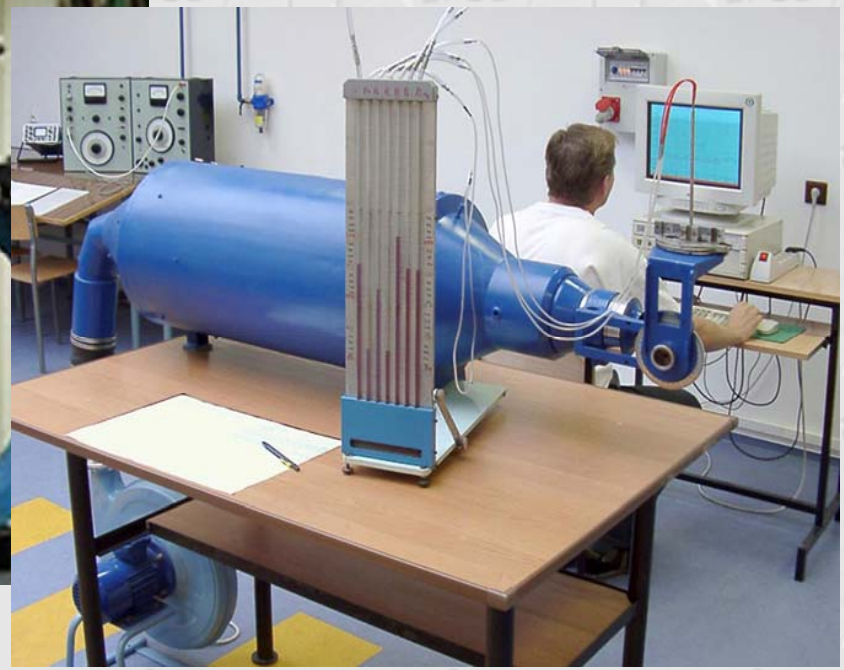
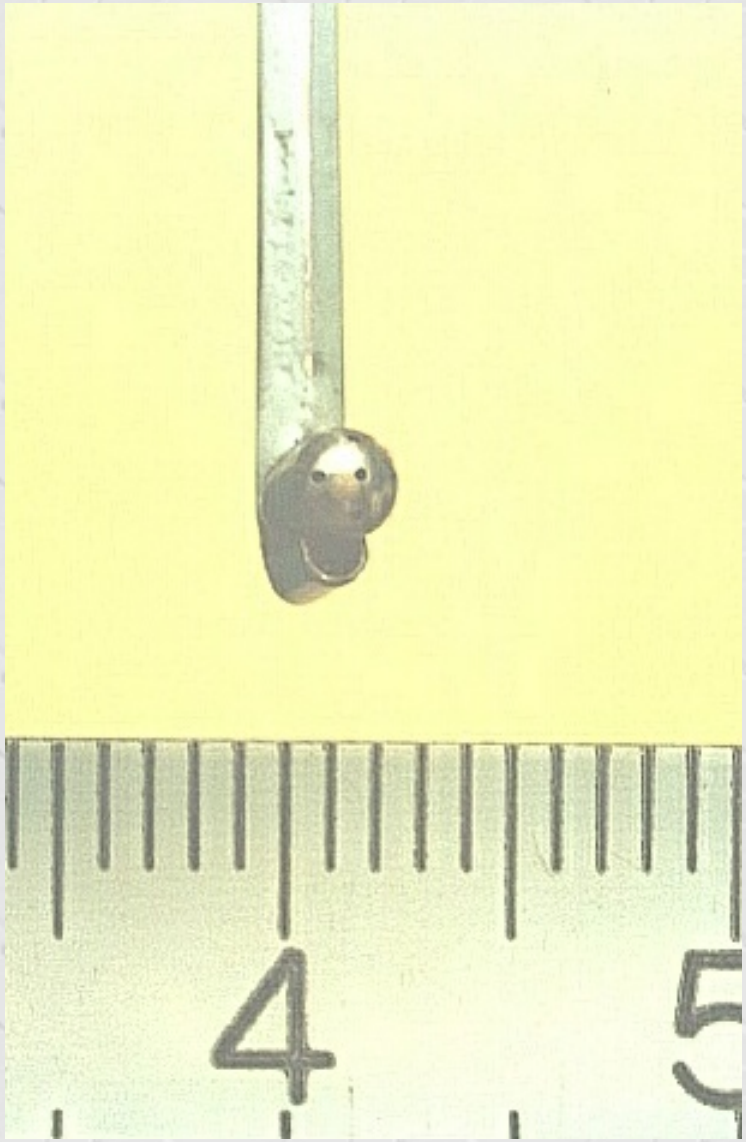
Wind tunnel for probe calibration



Wind tunnel for investigations of probe properties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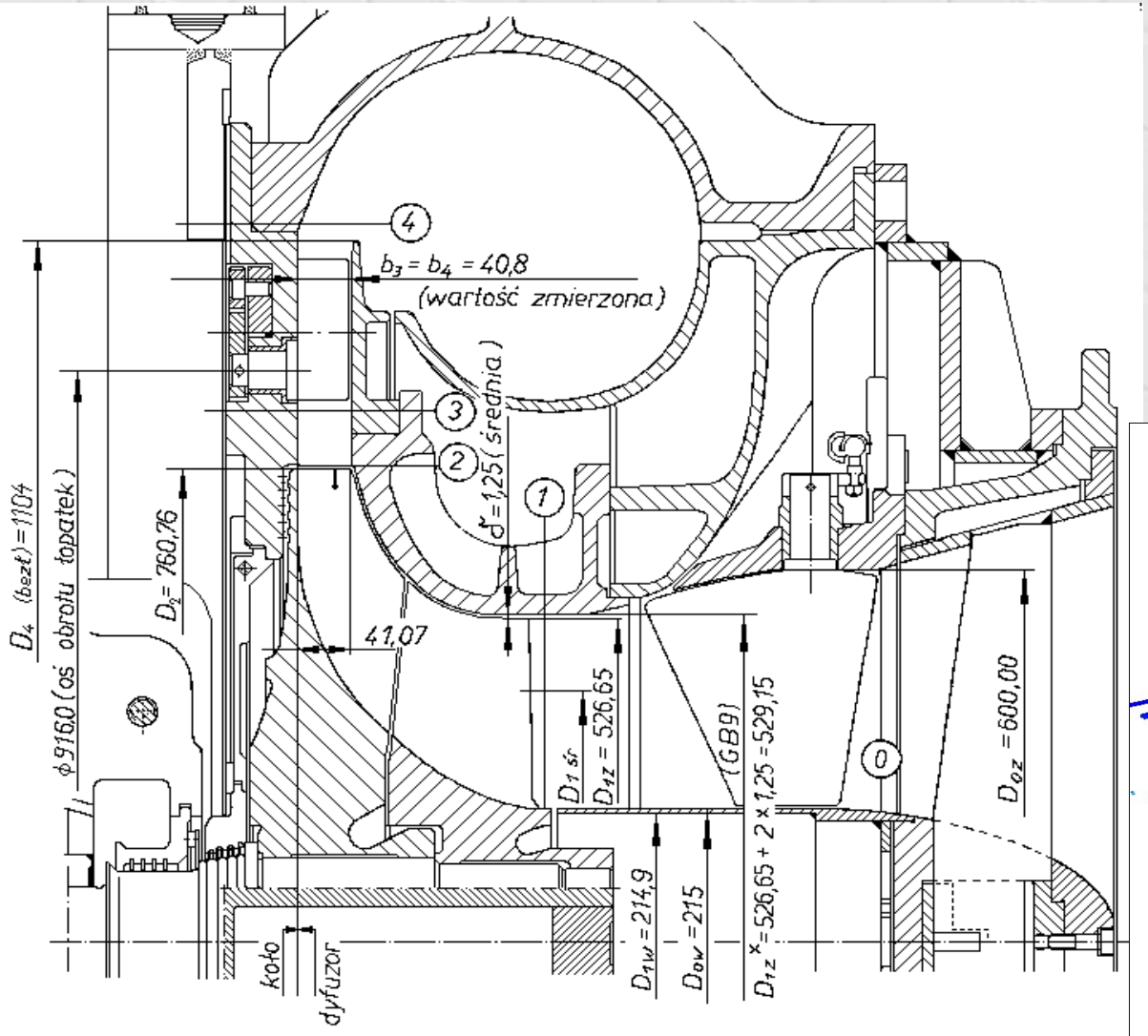
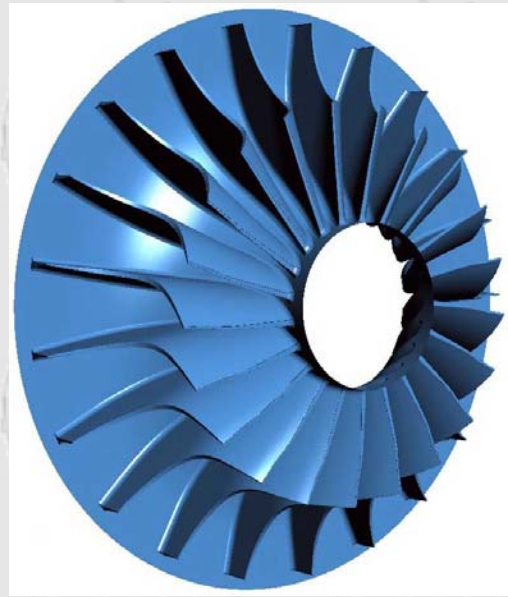
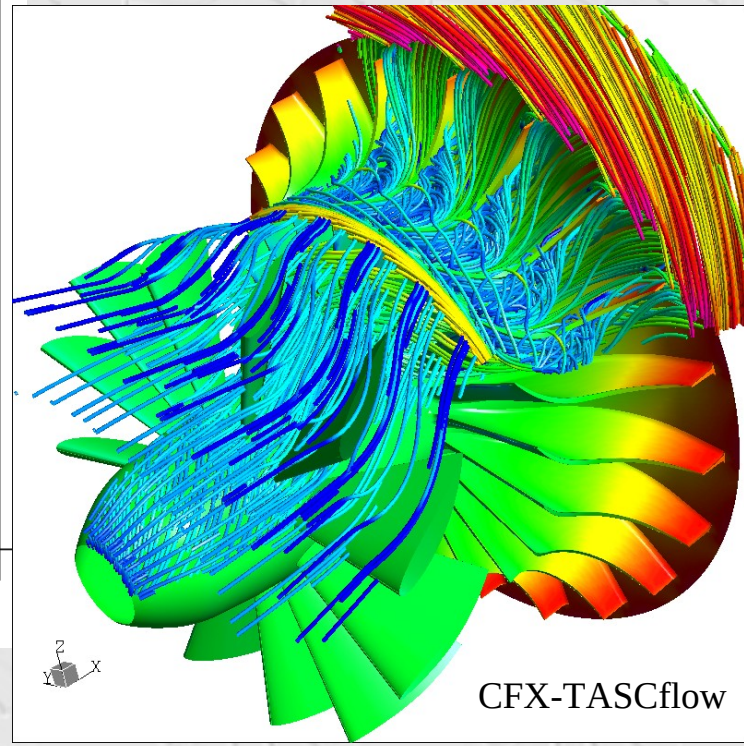
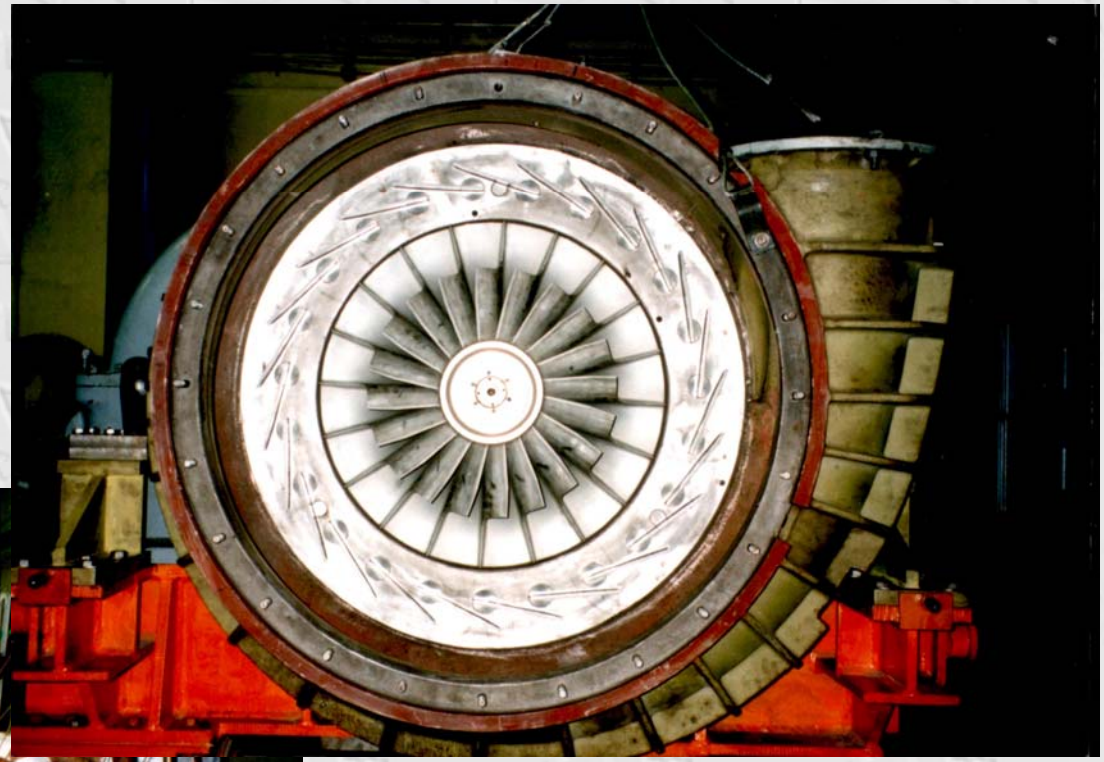
Cross-section of the 1.I1.76 centrifugal compressor

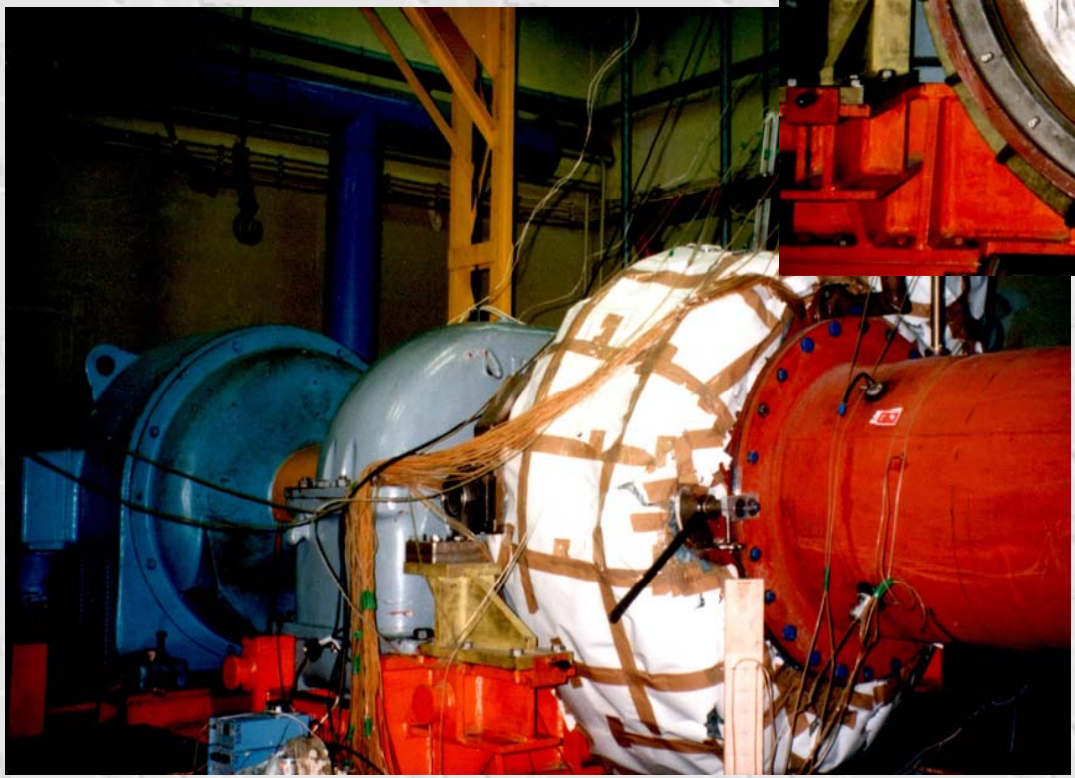




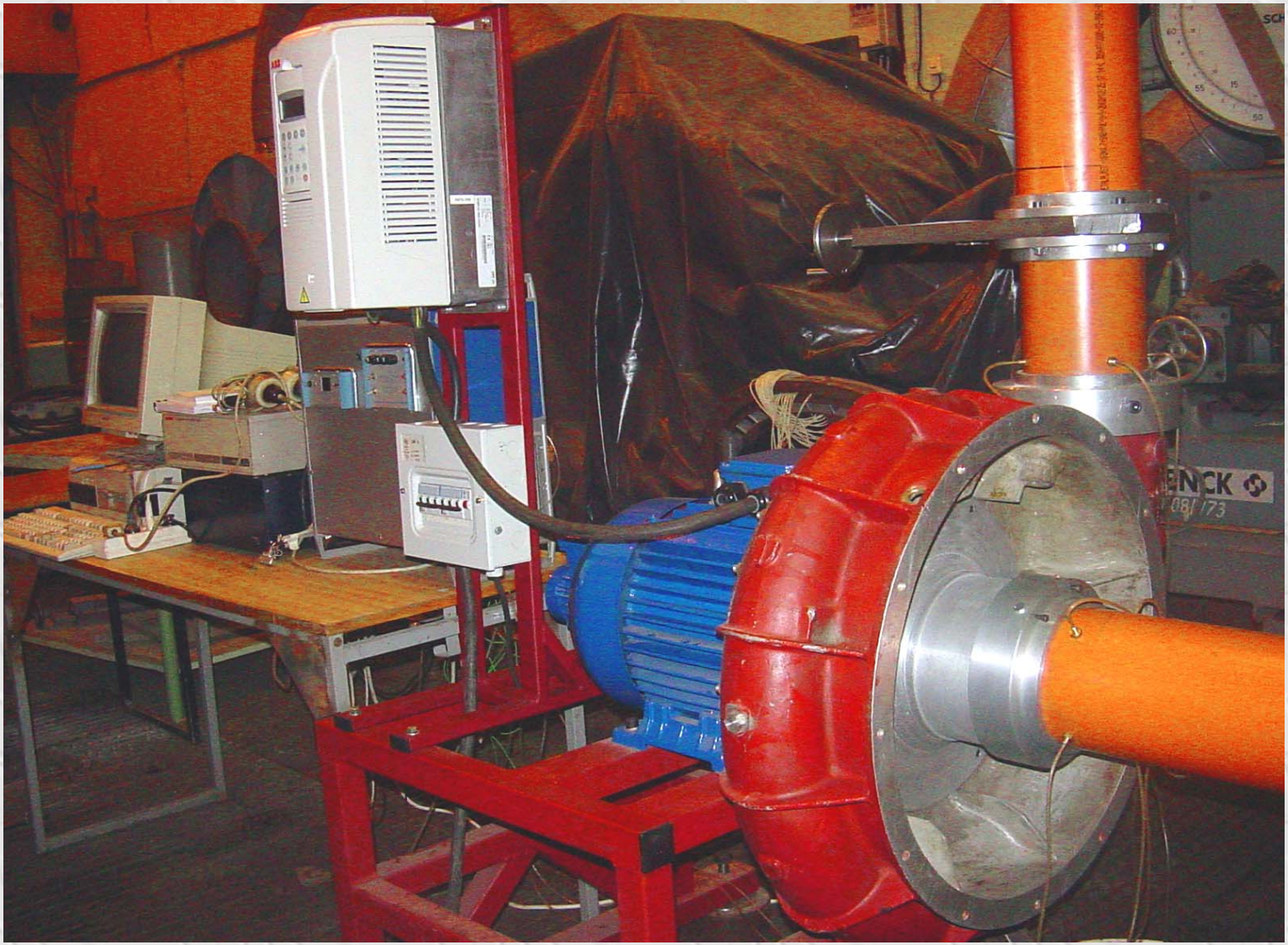


1.I1.76 centrifugal compressor

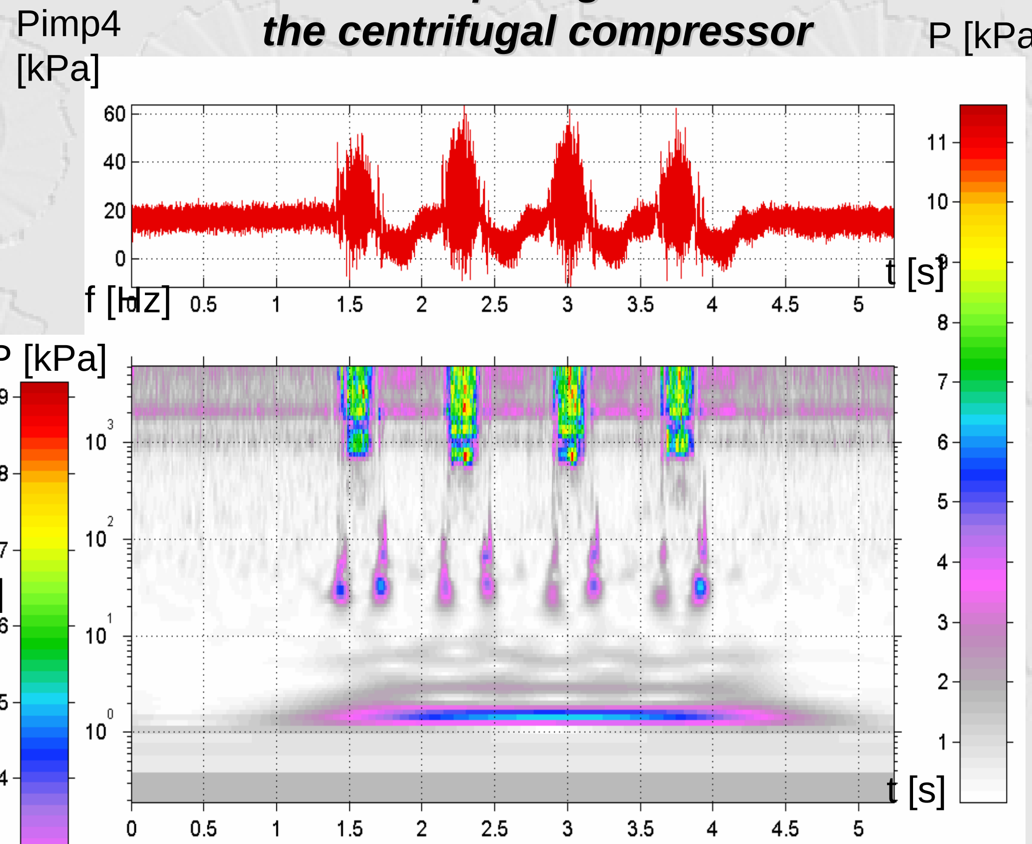




DP 1.12 centrifugal blower test rig

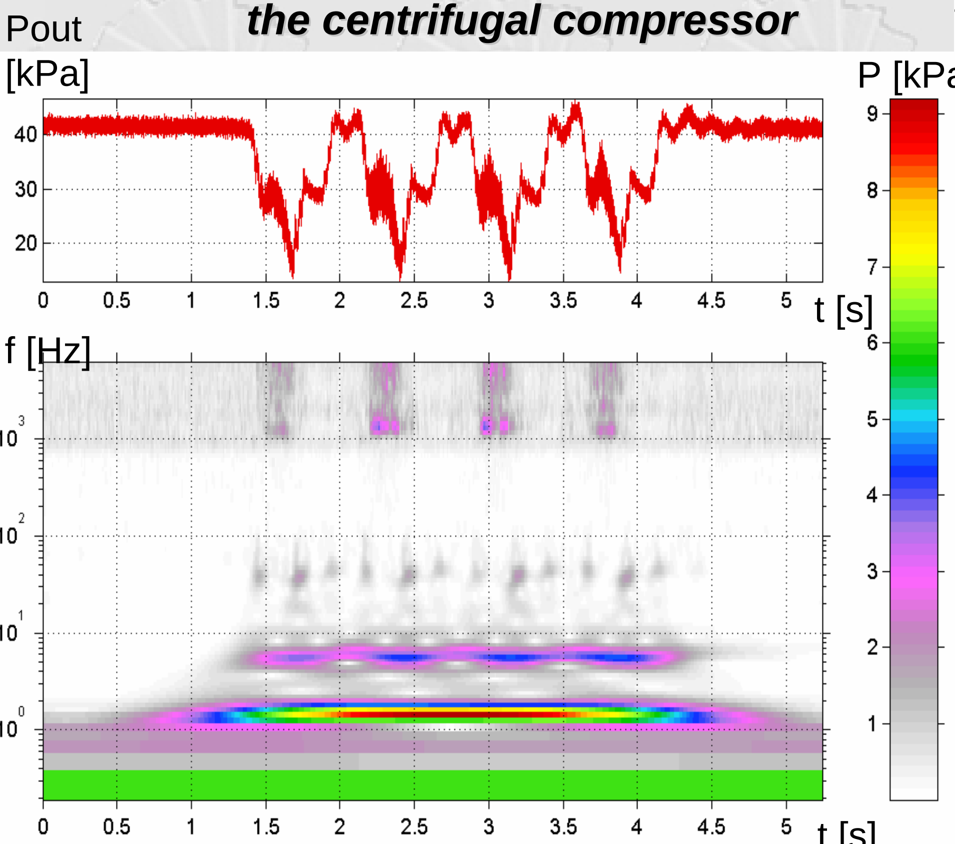


Deep surge of the centrifugal compressor



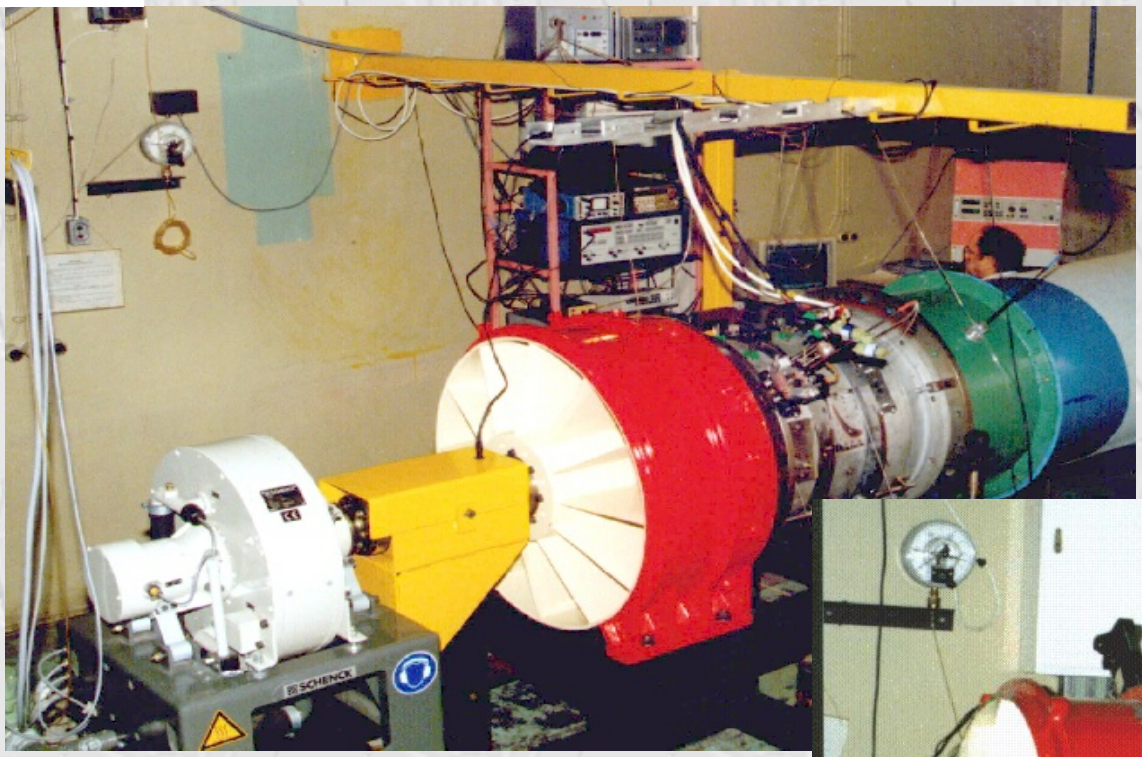
Static pressure at the impeller area and its time-frequency representation achieved by the continuous wavelet transform (Morlet wavelet, ω_0 = 6)

Deep surge of the centrifugal compressor

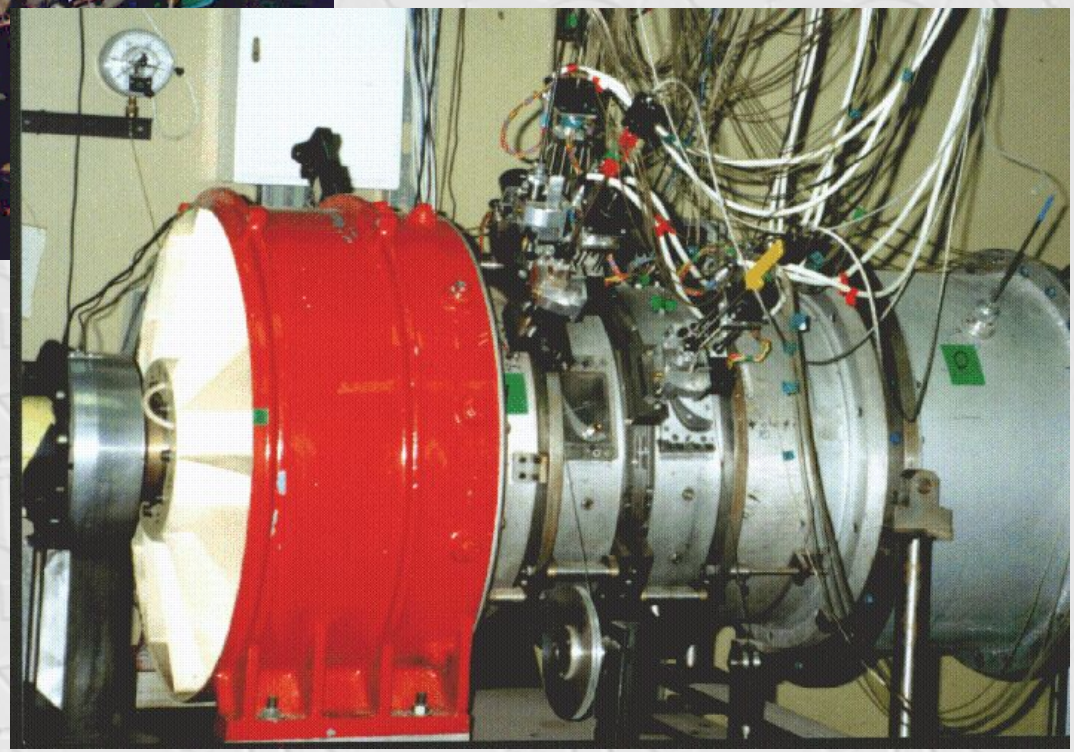


Static pressure at the compressor outlet and its time-frequency representation achieved by the continuous wavelet transform (Morlet wavelet, ω_0 = 6)

TM-3 two-stage low-pressure turbine



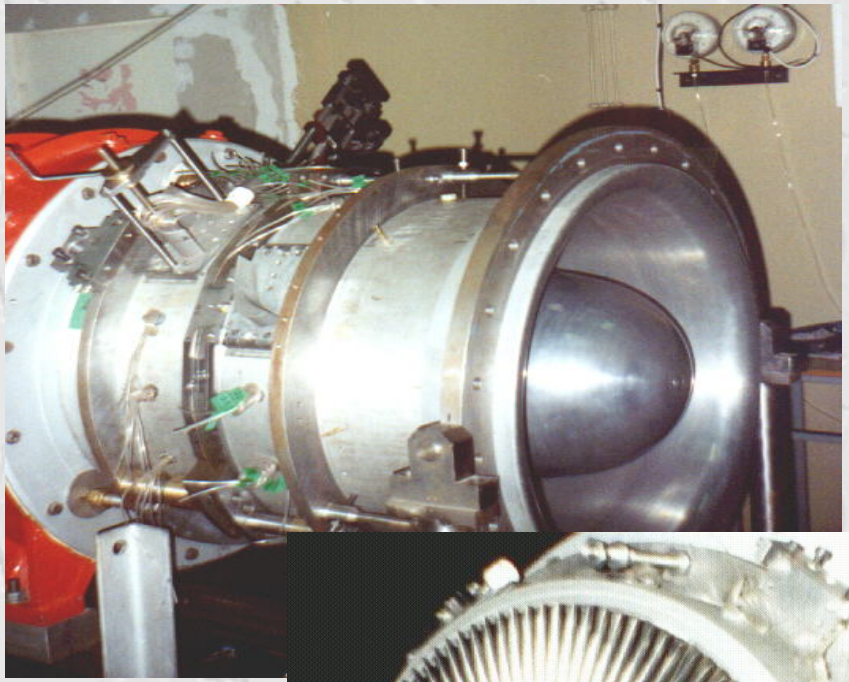
general view



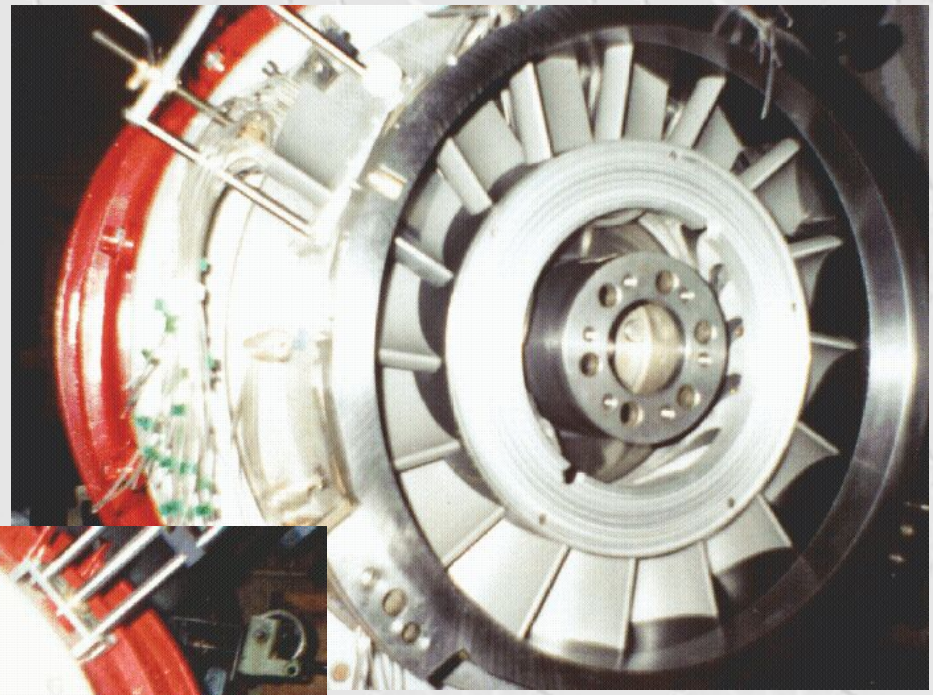
instrumentation

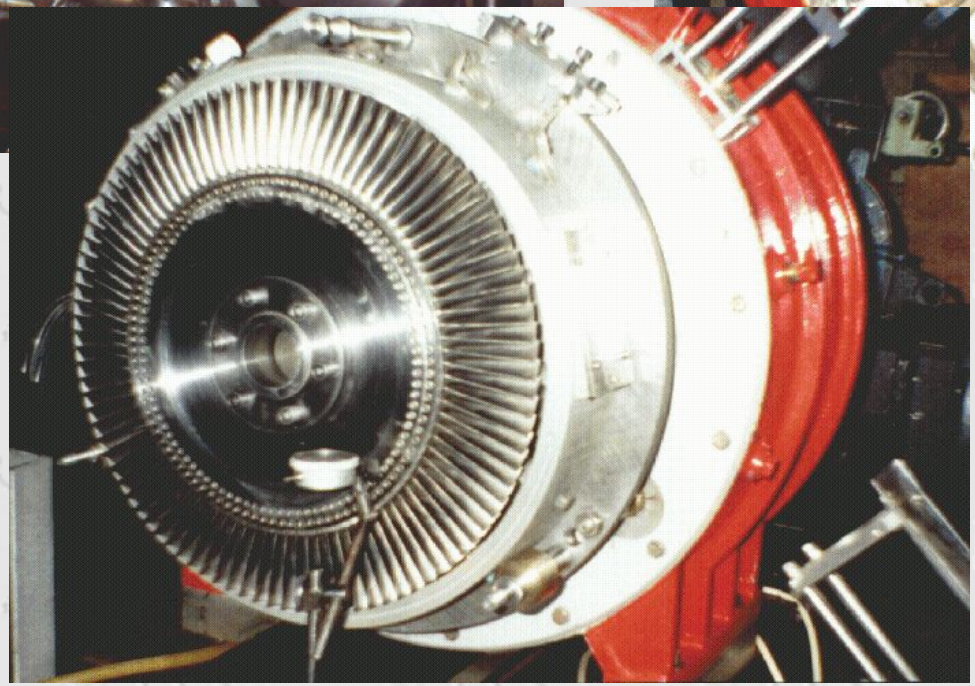
TM-3 turbine

Inlet



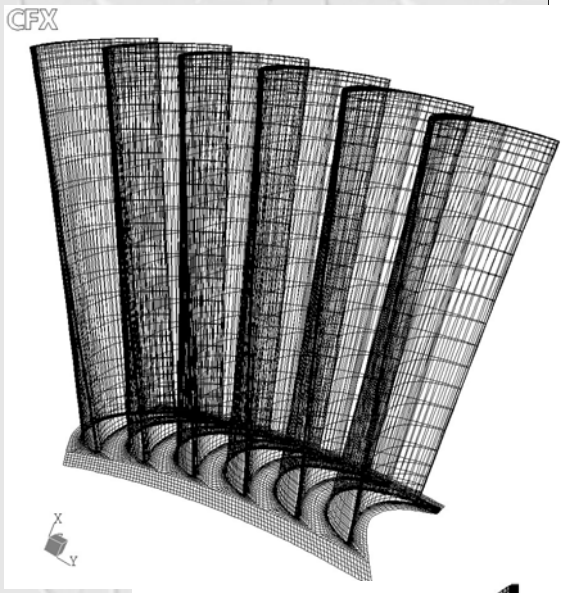
Stator vanes

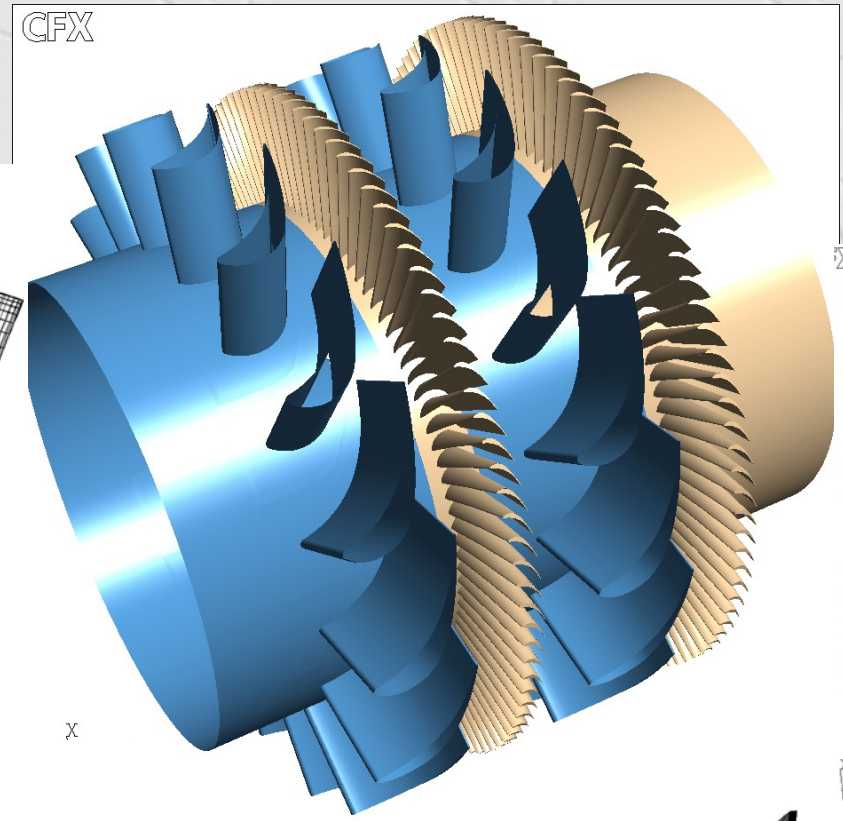


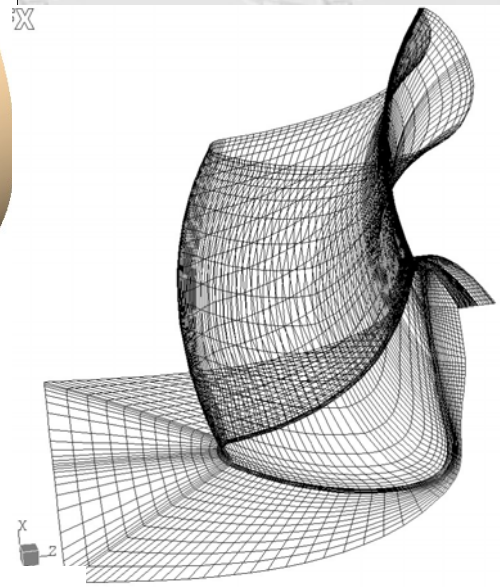


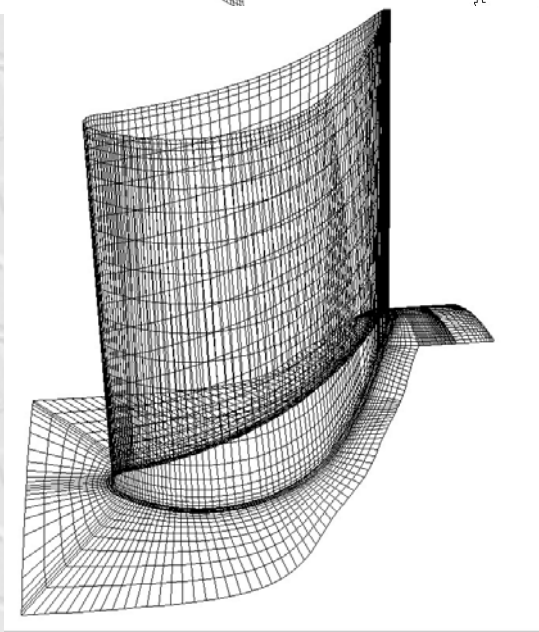
Rotor blading

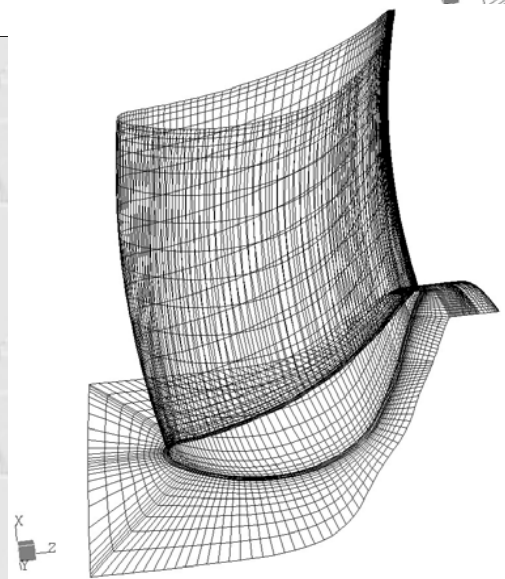
TM-3 turbine numerical model



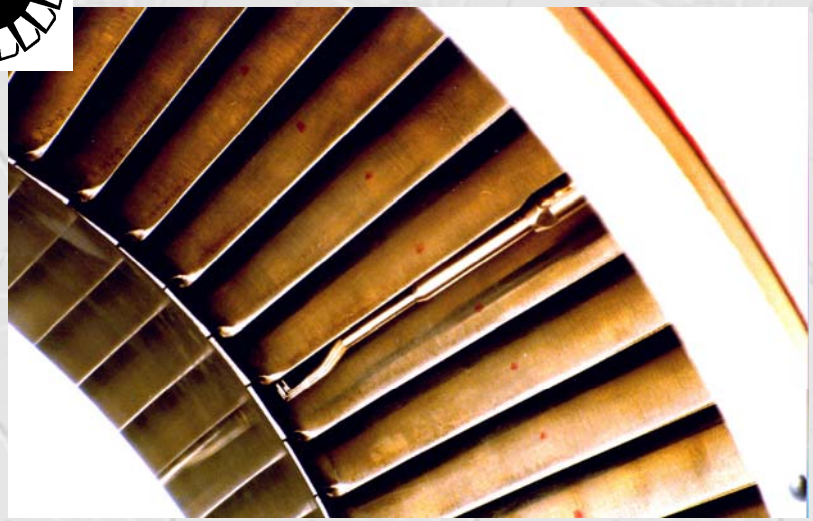


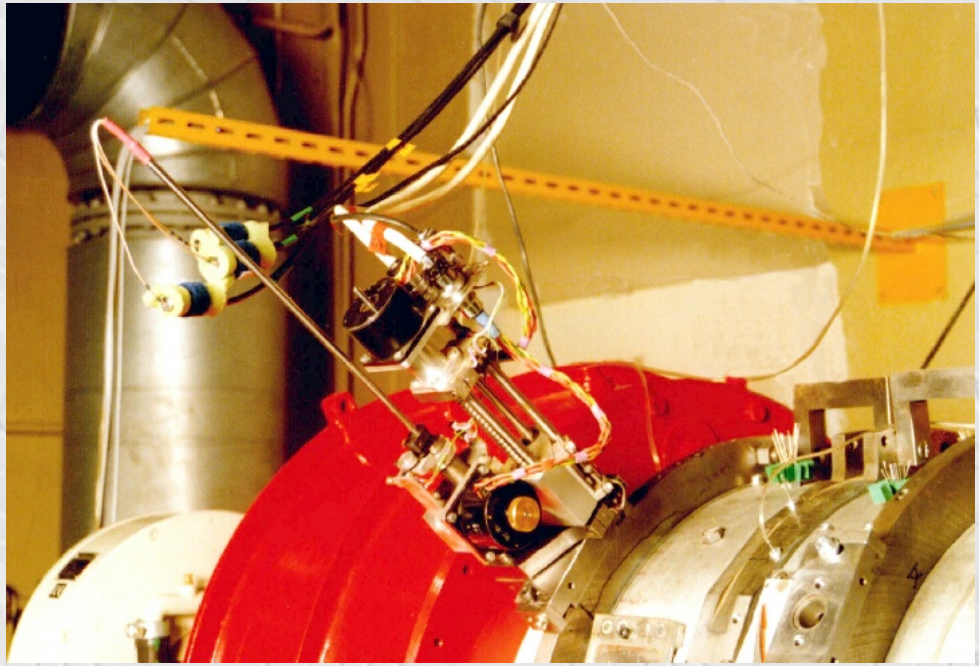


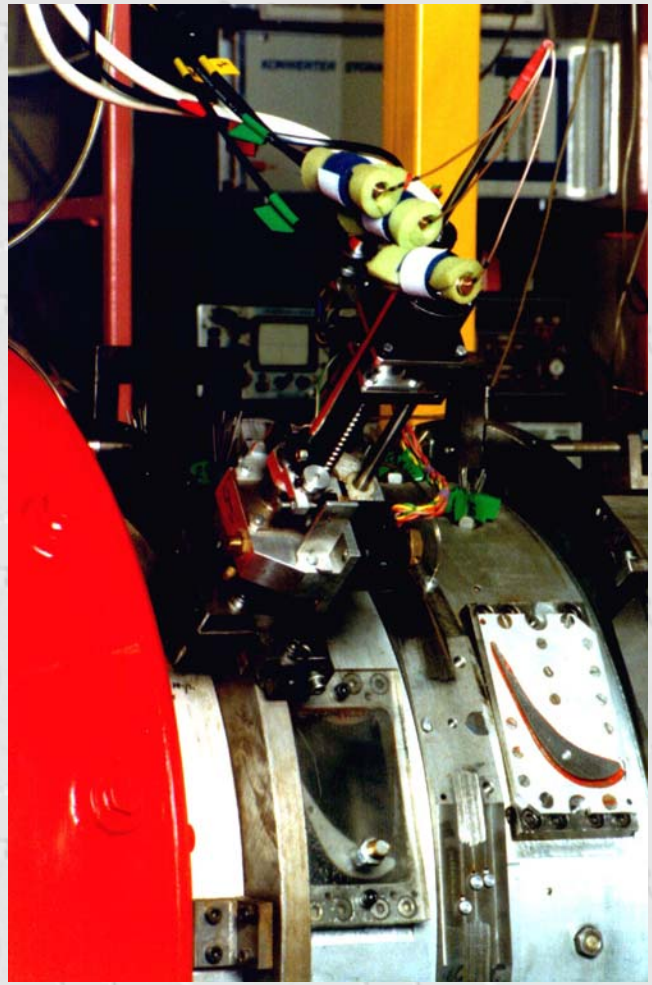




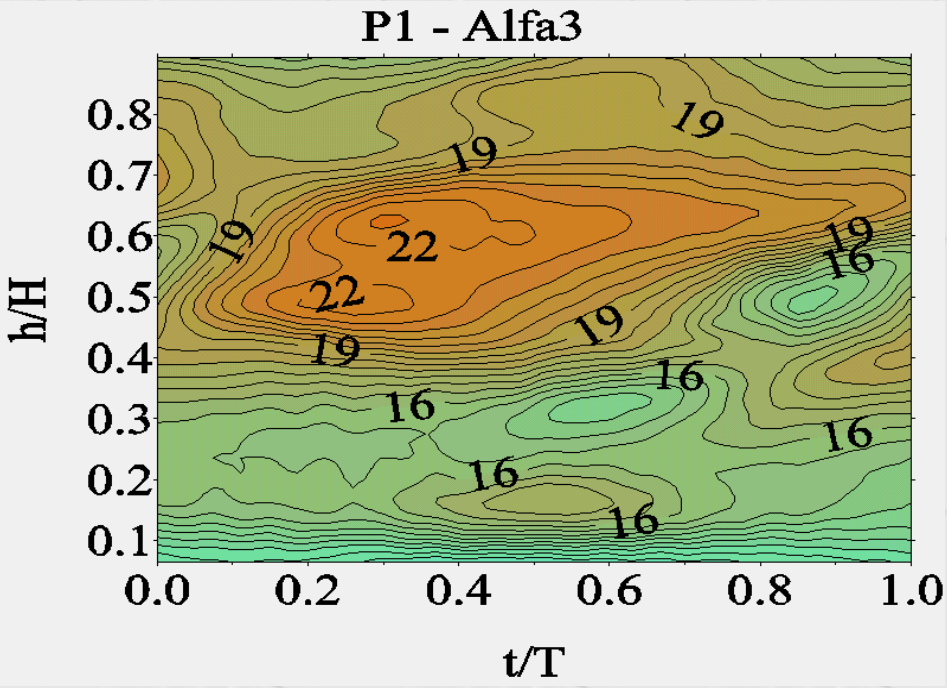
3D hot-wire probe

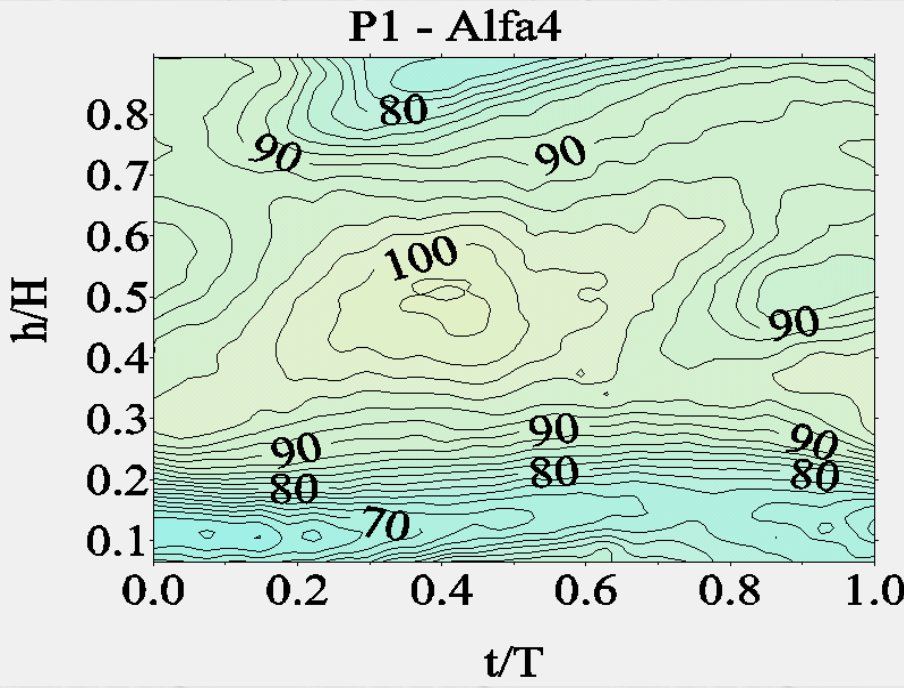






Measurement results





Flow angle behind the second stator [deg] (t/T – relative clocking position)

Flow angle at the exit of the turbine [deg] (t/T – relative clocking position)

Anechoic chamber

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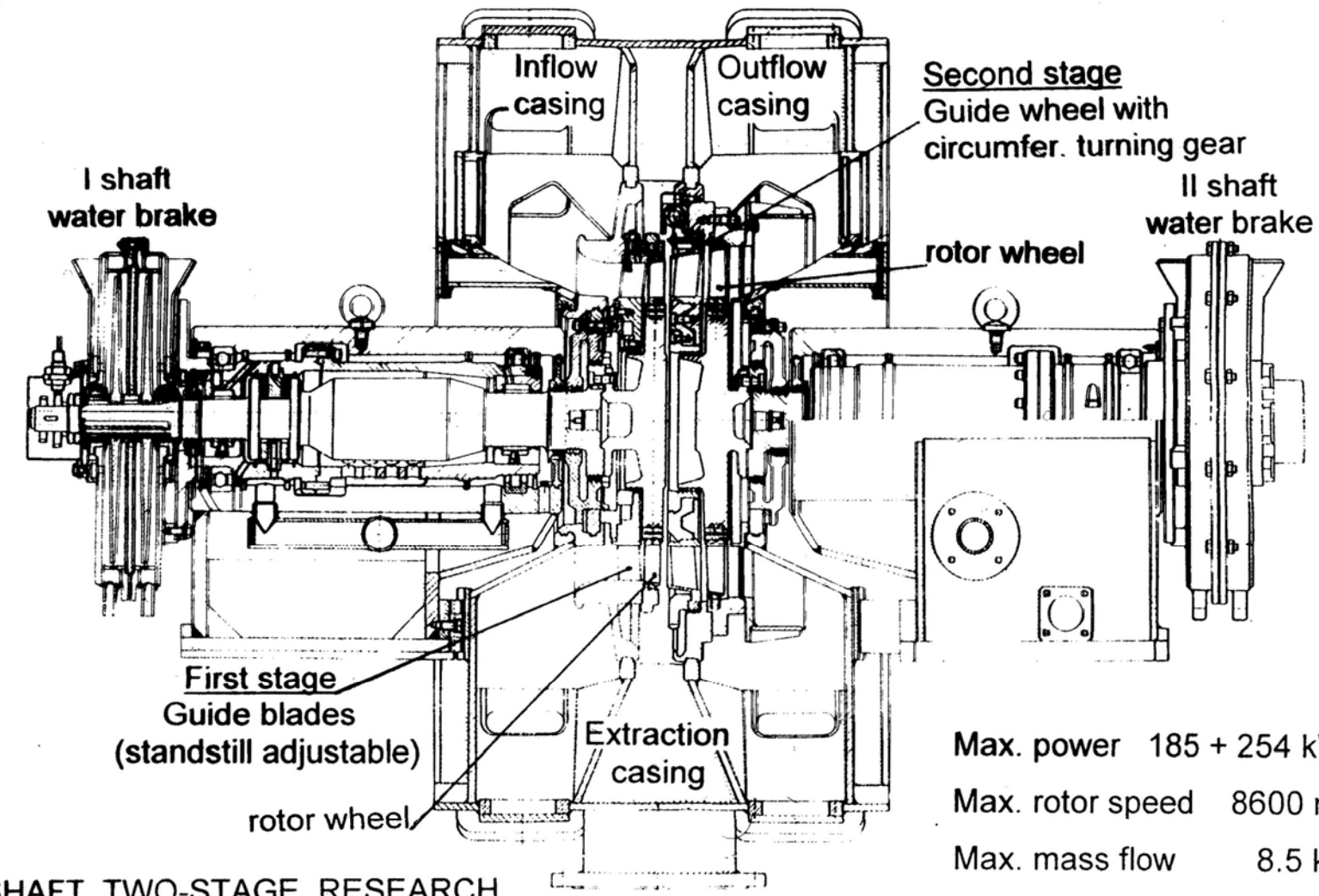
Anechoic chamber for aeroacoustic investigations of turbomachines

TM1 turbine test rig



Max. power 185 + 254 kW

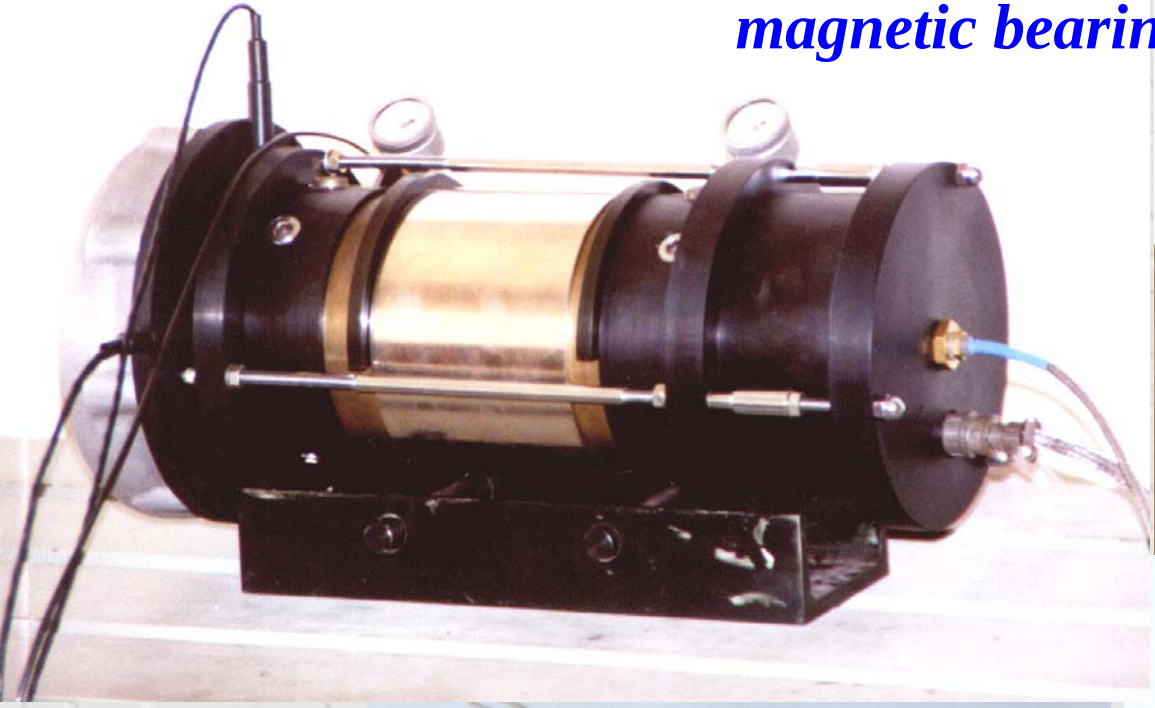
Max. rotor speed 8600 min^{-1}

Max. mass flow 8.5 kg/s

TWO-SHAFT TWO-STAGE RESEARCH TURBINE

Gas bearing machine designs and their realization

Model compressor with tilting pad gas bearings and a thrust magnetic bearing



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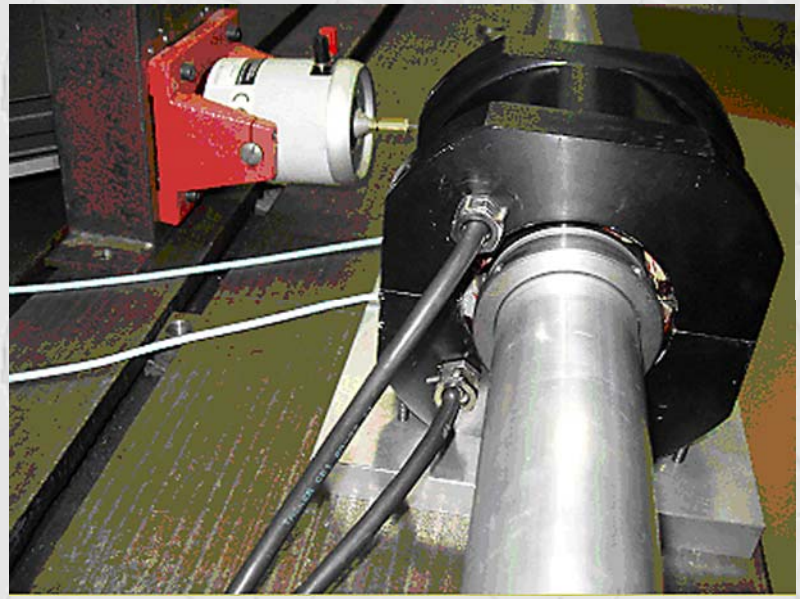
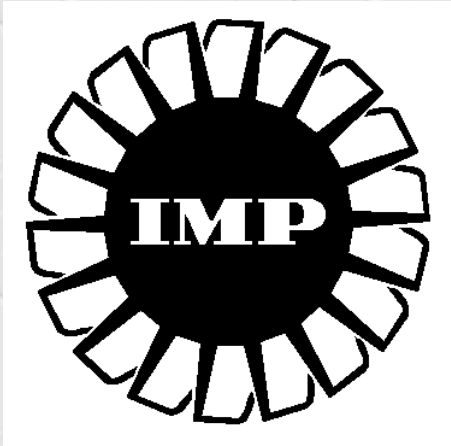
Test stand with a rotor supported in active magnetic bearings for identification of forces in the labyrinth seal



Active magnetic bearing for transverse vibration control in the model flexible shaft line

Thank you for your attention



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