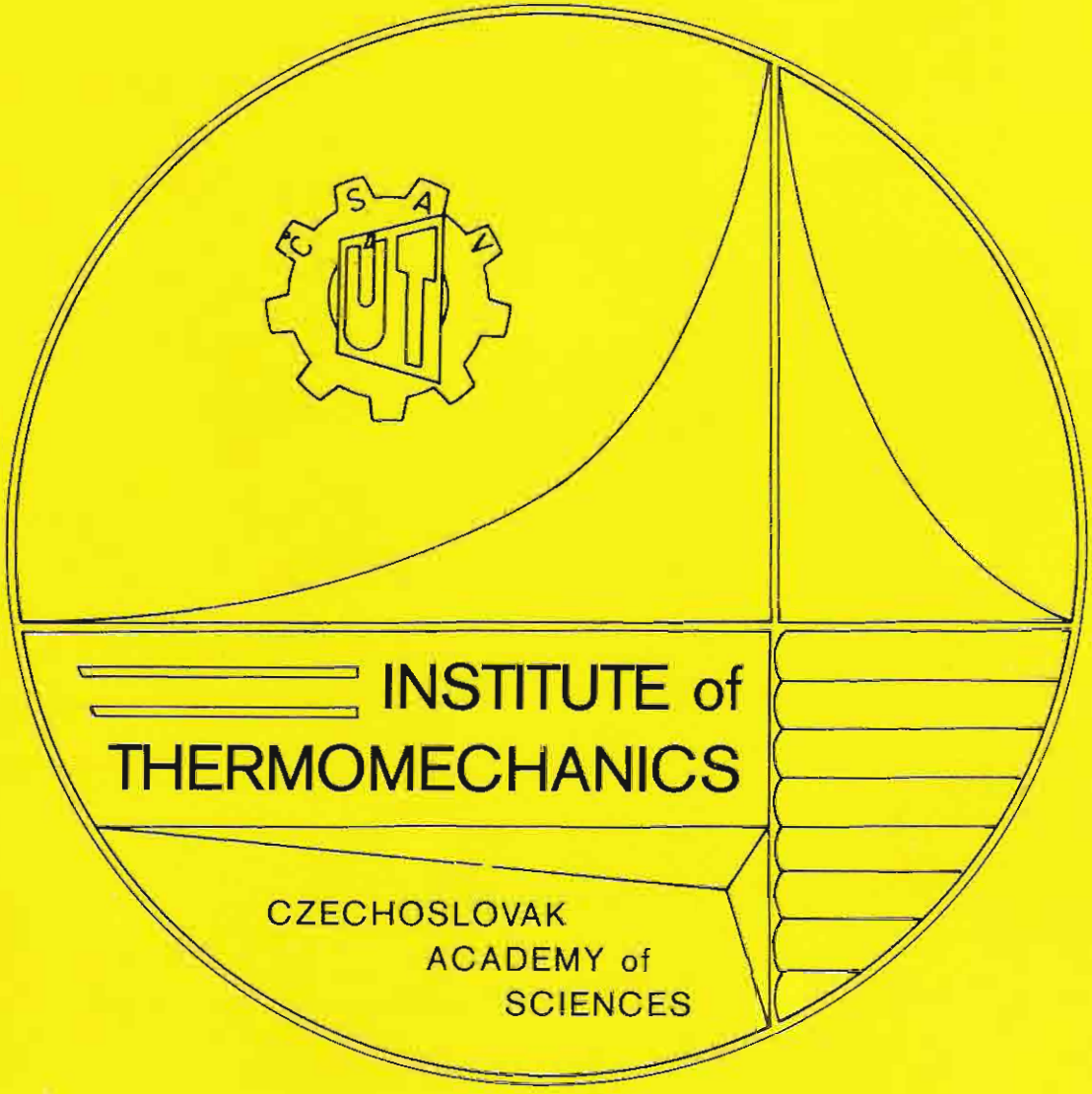
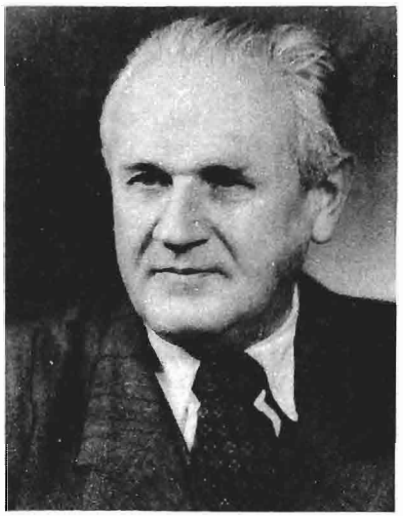

C S A V
U T
INSTITUTE of
THERMOMECHANICS
CZECHOSLOVAK
ACADEMY of
SCIENCES



In 1953 the late Professor Ladislav Miškovský, Corresponding Member of the Czechoslovak Academy of Sciences (ČSAV), gave the impetus to establish a MECHANICAL ENGINEERING LABORATORY of ČSAV to provide fundamental research in engineering sciences for the Czechoslovak industry.

At the very beginning the Laboratory concentrated mainly on fluid mechanics and thermodynamics - internal aerodynamics, boundary layers, thermal cycles,combustion, and heating and ventilation. Later on selected problems of solid mechanics were added. In 1955 the Laboratory became the INSTITUTE FOR MECHANICAL ENGINEERING of the ČSAV; nevertheless, the main orientation remained.

In 1962 the Presidium of the Academy decided that the Institute should concentrate on research in fluid dynamics and thermodynamics of gases at high temperatures and high velocities, on thermophysical properties of gases, boundary layers, turbulence and thermal cycles; in the field of solid mechanics on research into vibration of complex and nonlinear systems,including systems with shocks, and stress waves propagation in simple bodies,taking into account the real rheological properties of materials. At that time the Institute changed its title to the

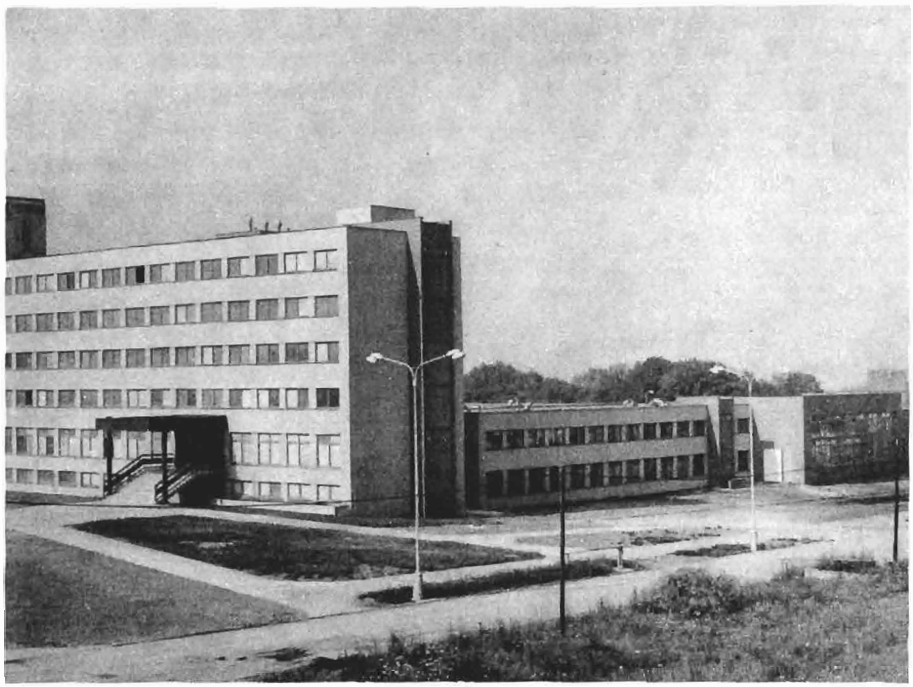
INSTITUTE OF THERMOMECHANICS of the ČSAV.

The present research activity, as confirmed by the Presidium of the Academy in 1980, covers fundamental research in thermomechanics, gas dynamics and solid mechanics, focusing mainly on the development of conventional and unconventional energy transformation and new projects and technologies in engineering, metallurgy and chemistry.

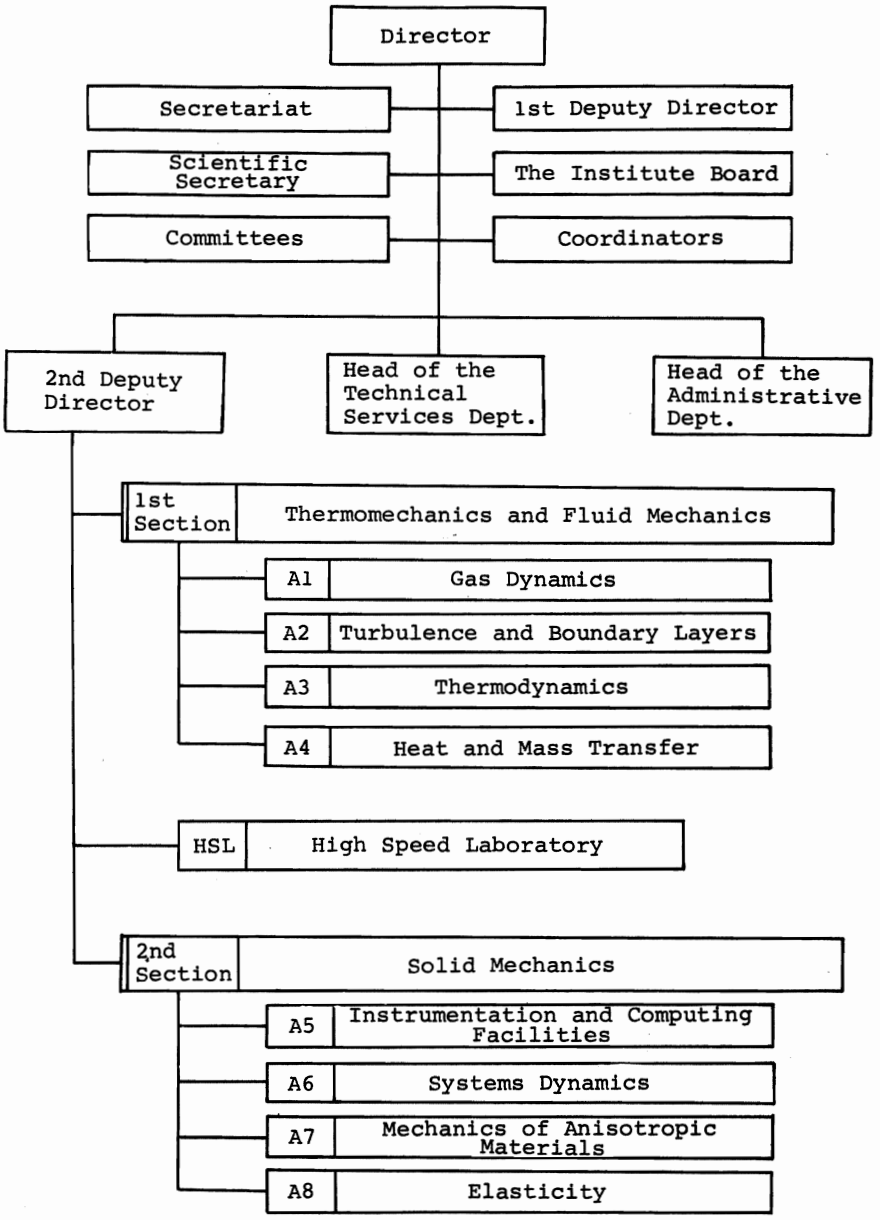
In the early days the Institute´s premises were located at several places in Prague. In 1958 the Institute acquired a new

shelter in Prague Dejvice, Puškin Square No. 9 with a few annexes nearby.

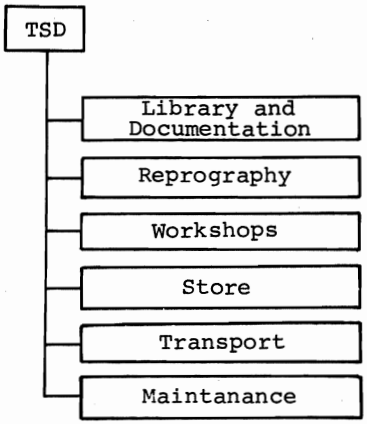
This inconvenient situation was solved in 1986, thanks to the concern of the Academy and the governmental authorities, by providing the Institute with new premises in the Academic campus in Prague 8, Na Slovance. They will house all laboratories and offices of the Institute, except for the High Speed Laboratory, still remaining at Nový Knín.

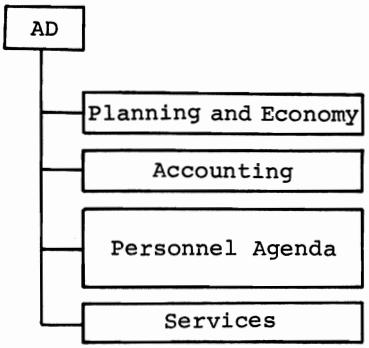


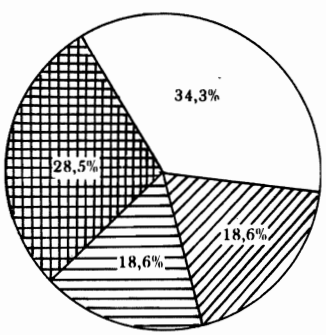
STRUCTURE of the INSTITUTE

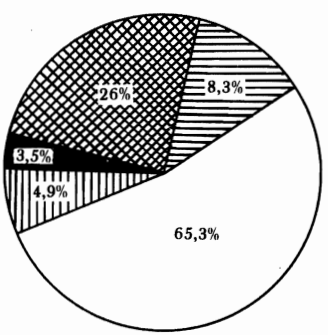


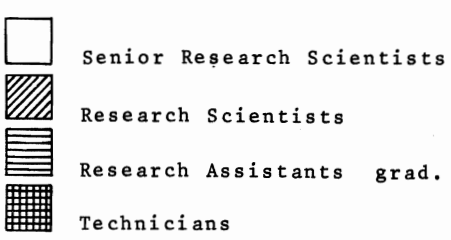
Ancillary to the Institute´s research sections are the Technical Services Department (TSD) and the Administrative Department (AD). They comprise

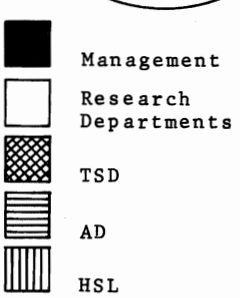












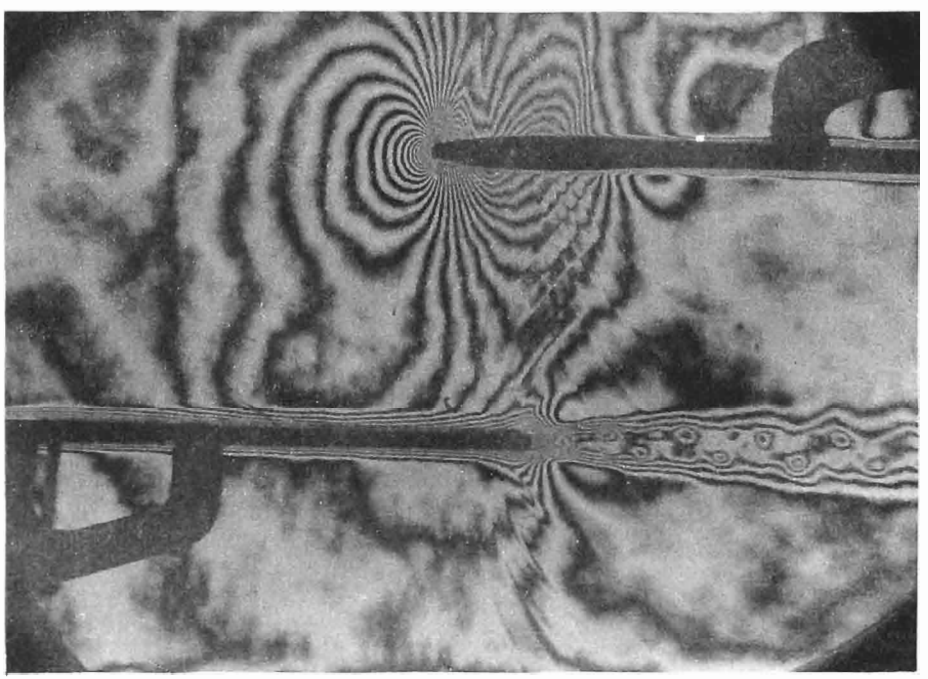
The staff total 150

- steady and unsteady transonic flow in closed channels, sidewall and curvature effects on the development of supersonic flow, shock wave and boundary layer interaction on sidewalls, outflow of a supersonic jet into a closed channel.

- transonic flow in cascades at off-design conditions, including flow at the entrance of radial flow diffusers.

- numerical methods for transonic flow calculations, optimization methods in aerodynamic design,

- means and methods of flow measurement in closed channels at transonic velocities and high turbulence



The origin of unsteady disturbances at transonic flow in a turbine cascade with an abrupt change of surface curvature

A2

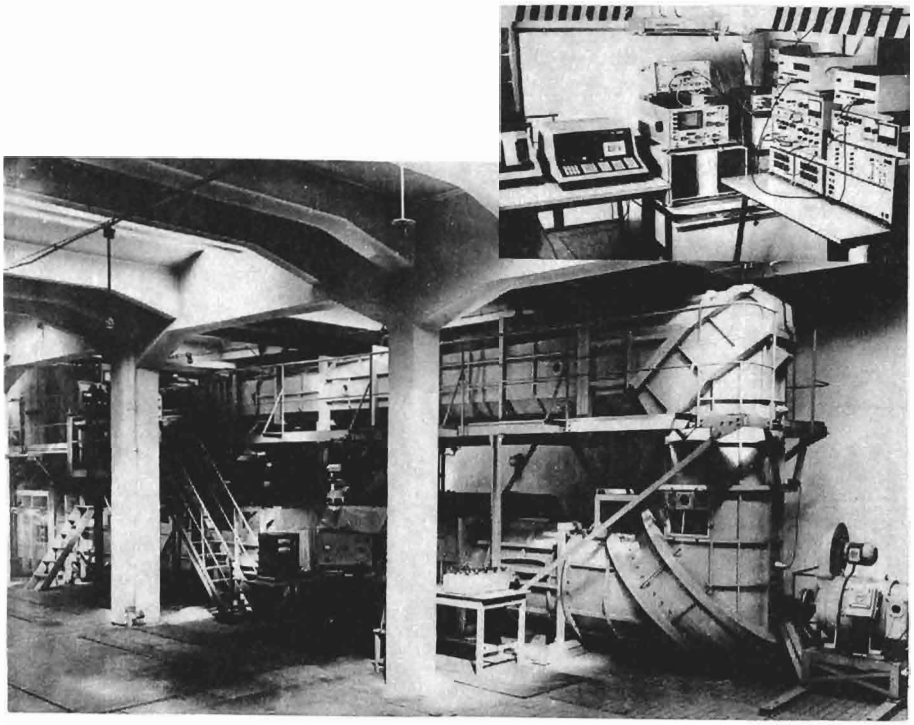
TURBULENCE and BOUNDARY LAYERS

- research into structure, universal characteristics and natural interaction of unsteady, highly turbulent, shear flows under conditions typical of internal aerodynamics,

- interaction of unsteady flows with solid and deformable bodies or surfaces,

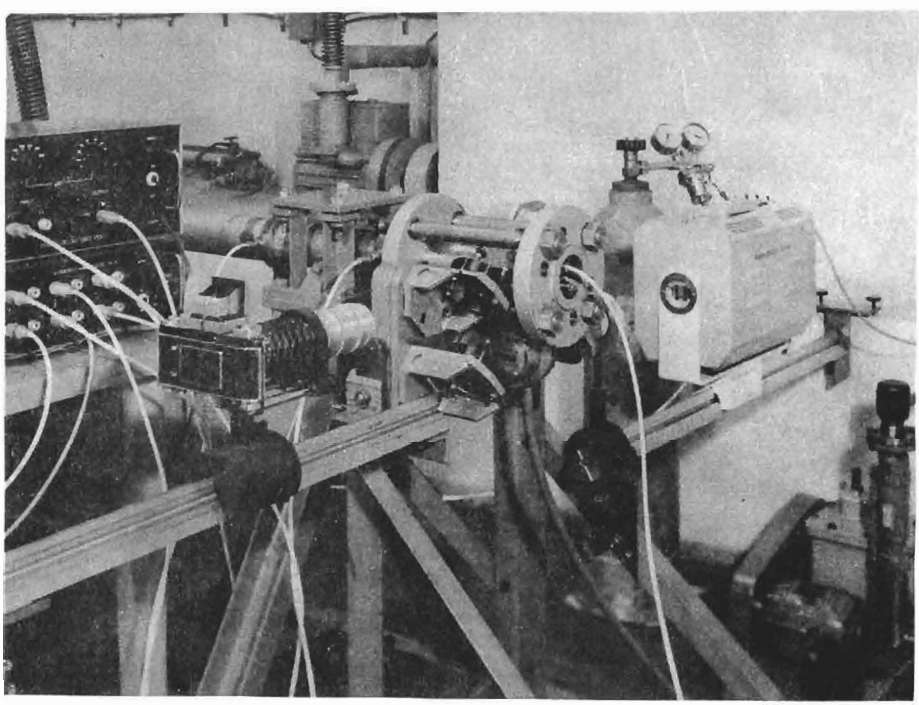
- development and improvements of physical models of turbulent shear and complex flows, including methods of calculation,

- research and further development of measuring methods for unsteady flows of gases, especially hot wire anemometry



A closed circuit wind tunnel with a measuring system for turbulence measurements

- mathematical description of thermodynamic properties of selected fluids in a wide range of pressures and temperatures,
- experimental research of thermodynamic properties of fluids of technological importance,
- experimental and theoretical research of nonequilibrium thermophysical properties of gases, relaxation processes in gases,
- experimental research and development of calculation methods of important thermodynamic processes for one - or multicomponent real fluids,
- analysis and optimization of thermal cycles with internal heat sources

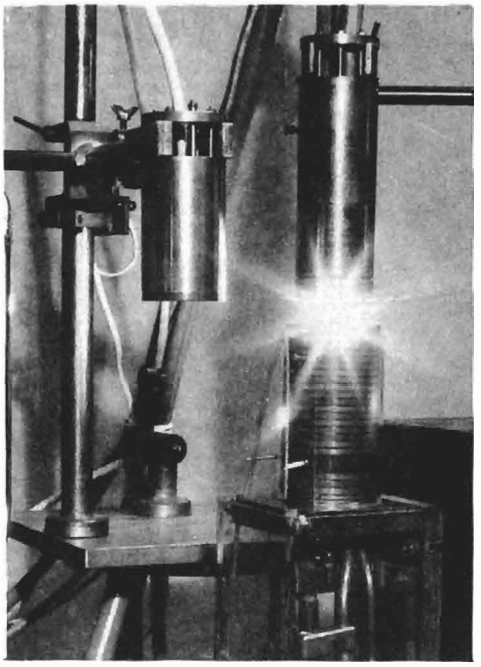


A shock tube equipped with a Mach-Zehnder interferometer for research into thermophysical properties of gases and their mixtures at temperature from 500 to 8000 K.

A4

HEAT and MASS TRANSFER

- experimental and theoretical research of phenomena in partly ionized free jets at high temperatures, high velocities and under external fields,
- convective heat transfer from a gas stream into a wall and heat transfer by radiation
- velocity, pressure and temperature fields in high temperature gas dynamics,
- numerical methods for unsteady heat transfer and flows of gases at high temperatures,
- research and development of diagnostic methods, including evaluation and automation of measurements,
- development of means for producing high temperature gas flows



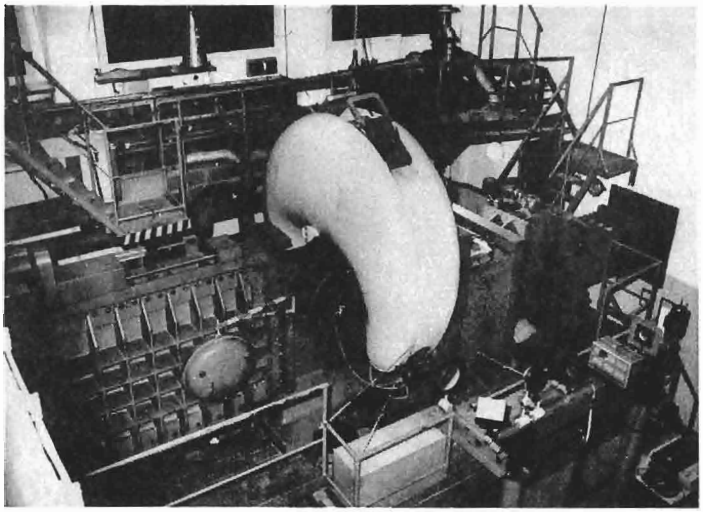
A study of a perpendicular impact of a high temperature argon free jet on a cold wall

The High Speed Laboratory is an autonomous laboratory of the Institute located at Nový Knín. This location enables to utilize abandoned galleries of past gold-ore mines as a vacuum storage of volume of 6500 m^3. Several intermittent high speed wind tunnels are breathing atmospheric air through a silicagel dryer and filters into this evacuated volume.

The largest wind tunnel (test section 160 x 450 mm) is for cascade research. The full range of velocities up to M ~ 2 including transonic ones can be achieved both in the inlet and outlet of the cascades measured. The wind tunnel is equipped with a Mach-Zehnder interferometer, schlieren optics, and a semi - automatic traversing device to measure the cascade losses.

Further, there are test rigs for radial flow cascaces and diffusers, a small transonic wind tunnel for studying flow in relatively narrow channels, a test section for probe calibration, a subsonic wind tunnel (up to M ~ 0,8) with wall suction where the turbulence level can be controlled from 0.2 - 15%, as well as a low velocity wind tunnel for studies of pressure fluctuations in the flow field.

General view of the High Speed Laboratory at Nový Knín



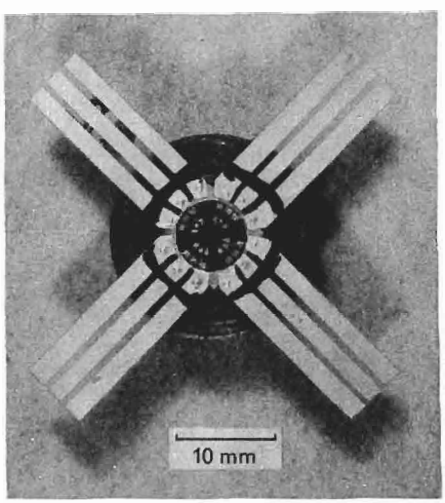
Wind tunnels in the High Speed Laboratory

a) a high speed wind tunnel with an adjustable turbulence level and a high speed wind tunnel for cascade research, equipped with a Mach-Zehnder interferometer

b) The LDA set for measuring the velocity vector during studies of the transonic shock wave/boundary layer interaction in narrow channels

- development of semiconductor piezoresistive transducers for measurement of pressures, forces,acceleration and displacement,
- a computer-aided optimization of elastic transforming elements of transducers with silicon diaphragms,
- development of special electronic devices and experimental equipment for research in mechanics,
- implementation of information measuring systems for data acquisition and micro-computer-controlled scientific measurements,
- development of microprocessor technology and its application in automation of data acquisition in experimental research in mechanics,
- development of minicomputer systems for scientific calculations, treatment and evaluation of measured data

Setting up a special semiconductor transducer. Seen in the background a test rig for transducer calibration



The active element of the semiconductor transducer: a silicon diaphragm with eight ion implanted strain gauges, arranged into four half-bridges

A6

DYNAMICS of SYSTEMS

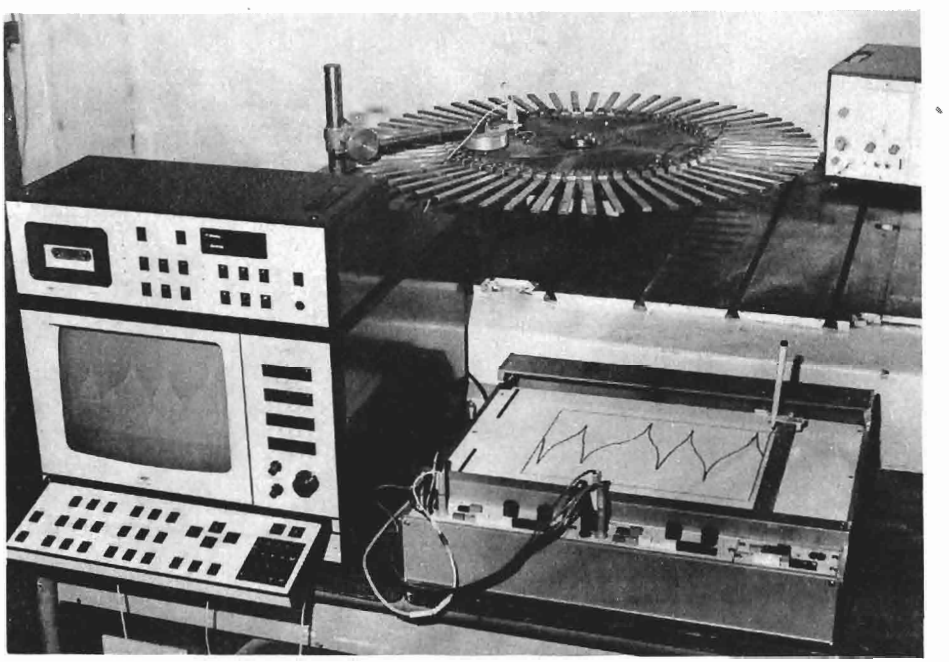
- theoretical and experimental research of dynamic characteristics of complex machine elements and mechanical systems, including identification

- modelling, analysis and synthesis of nonlinear and linear systems with active and parametric elements

- analysis of dynamic characteristics, forced vibration and stability of elastic bodies in a flowing fluid

- development of autonomous devices for measurements automation, treatment and evaluation of measured data, control of experiments in dynamic tests of machine elements and their models

- development of analytical methods for dynamic systems and mechanical systems using symbolic simulation on a digital computer



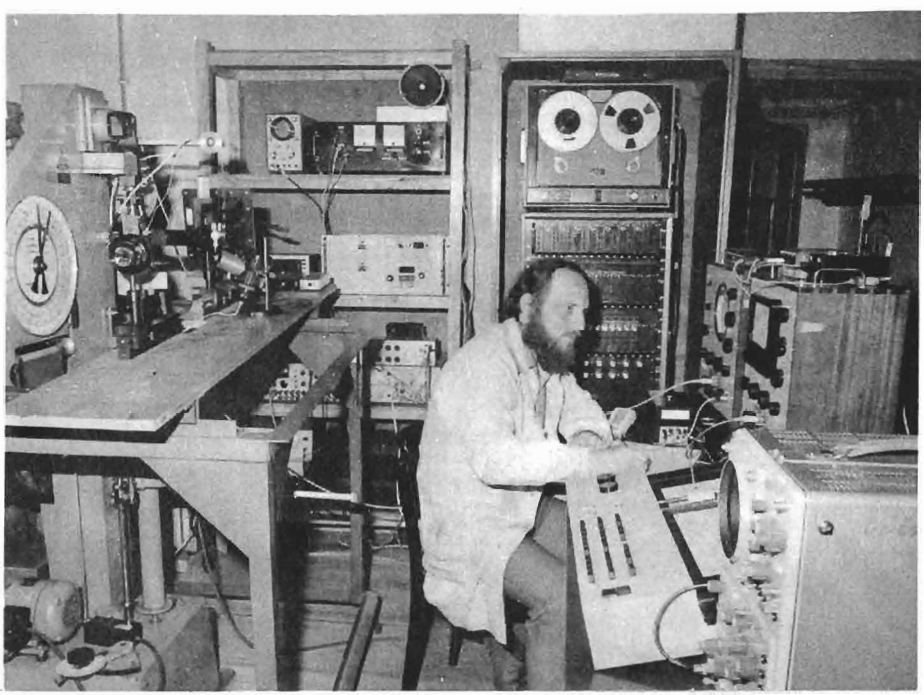
Investigation of the dynamic properties of a model of a steam turbine rotor disc

- evaluation of stress and strain characteristics of polymer composites reinforced by long fibres on the basis of their component properties and texture, considering also the effect of production technology,

- experimental research in mechanical properties of composites at static and dynamic loading,

- development of nondestructive testing methods (namely, acoustic emission and ultrasonics) to determine the degree of damage and the residual life time

- research into the effect of technological defects and their propagation under strain and environmental interaction



Experimental facility for studying correlations between acoustic emission and fracture processes in polymer composites

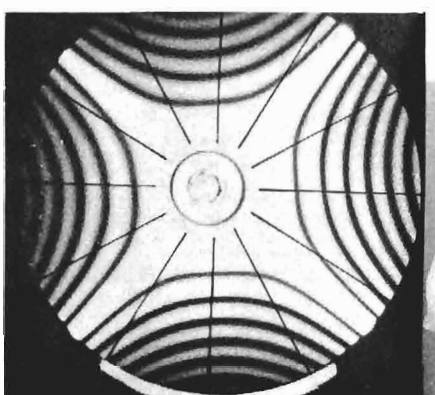
A8

ELASTICITY

- research into the propagation of stress waves and force pulses in elastic bodies and systems of bodies with linear and complex material characteristics,
- research into dynamic and geometrical factors affecting the crack initiation and propagation in bodies
- limit states analysis of machine elements and structures subjected to impact loading,
- research into characteristics and optimization of dissipative systems for suppressing undesirable effects of shocks,
- analysis of contact problems typical of damping by design and rigidity of dynamically loaded structures.

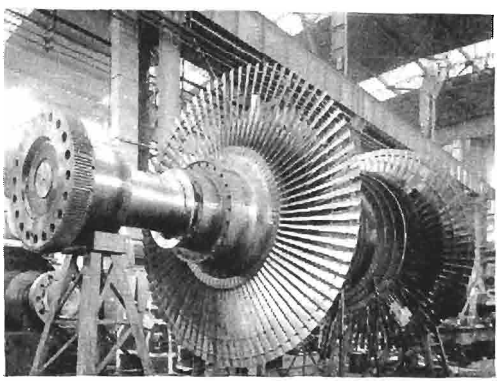
Adjusting a holographic set for resonant vibration studies of a radial flow compressor disc.

A picture of resonant vibration of a thin centrally clamped disc, obtained by means of the time average method

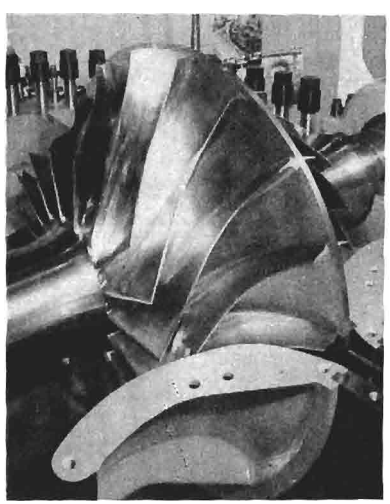


The Institute of Thermomechanics is the Coordinating Body of four Principal Programmes and the seat of the Board of Project III-5 of the National Plan of Fundamental Research. The Institute also takes part in Project III-2.

The coordinating function within the National Plan of Fundamental Research guarantees a unifying conception of research in all participating institutions and, at the same time, concentration of their research effort in the field of fluid and solid mechanics on the most topical problems.



The Institute of Thermomechanics is the only Institute of the Academy providing interrelated fundamental research in both fluid and solid mechanics relevant to the prospective needs of Czechoslovak industry and power engineering. In addition to solving fundamental problems of development and methodology in the particular scientific fields, as well as of meeting the future demands of the Czechoslovak national economy, the Institute closely collaborates with institutes of applied research and with the leading industrial enterprises, as, e.g., ŠKODA Works, ČKD-Prague, ZPA ... This collaboration promotes and ensures not only the flow of results from the fundamental research into applied research and industry, but also the stimulating feedback for the fundamental research, This is why collaboration with industry has always occupied a considerable part of the Institute´s activity.



INTERNATIONAL COOPERATION

In the course of time the Institute has established wide international contacts and cooperation, based especially on the agreements of the Czechoslovak Academy of Sciences and the Academies of other socialist countries. Recently the cooperation has developed up to the level of joint research, cooperative utilization of experimental and computation facilities. Outstanding results have been obtained namely through collaboration with the Institutes of the U.S.S.R. Academy of Sciences in Moscow and Novosibirsk, Ukrainian Academy of Sciences in Kiew and Charkow, Byelorussian Academy of Sciences in Minsk, Latvian Academy of Sciences in Riga and with Institutes of the GDR Academy of Sciences in Jena, Karl-Marx-Stadt and Berlin.

The Institute takes part in the activity of the International Centre for advanced professional training in heat and mass transfer, attached to the Institute of Heat and Mass Transfer, Byelorussian Academy od Sciences, Minsk. To comply with the request of the Centre, a Base Laboratory for Diagnostics of Turbulent Gas Flows was founded in the Institute.

The Institute of Thermomechanics is also active in two Problem Committees of Multilateral Scientific Cooperation of the Academies of Socialist Countries in the field of mechanics and physics - technological problems of power generation.

A close and longstanding collaboration of the Institute with the International Association for Properties of Steam - IAPS has a good tradition. The Institute, being a collective member and national representative in IAPS, cooperates with its members in the research and standardization of thermophysical properties of water and steam.

Under the cultural agreement between France and Czechoslovakia the Institute has close relations with the University of Besancon. The Institute also collaborates with the Project Centre of Thermodynamic Tables - IUPAC and numerous other institutions in the field of thermophysical properties of fluids.

The staff scientists are engaged in teaching duties in universities and, vice versa, the university staff take part in the research activities of the Institute. The Institute members are active in governing bodies of the National Plan of Fundamental Research, as well as in its Assessment and Advisory Councils.

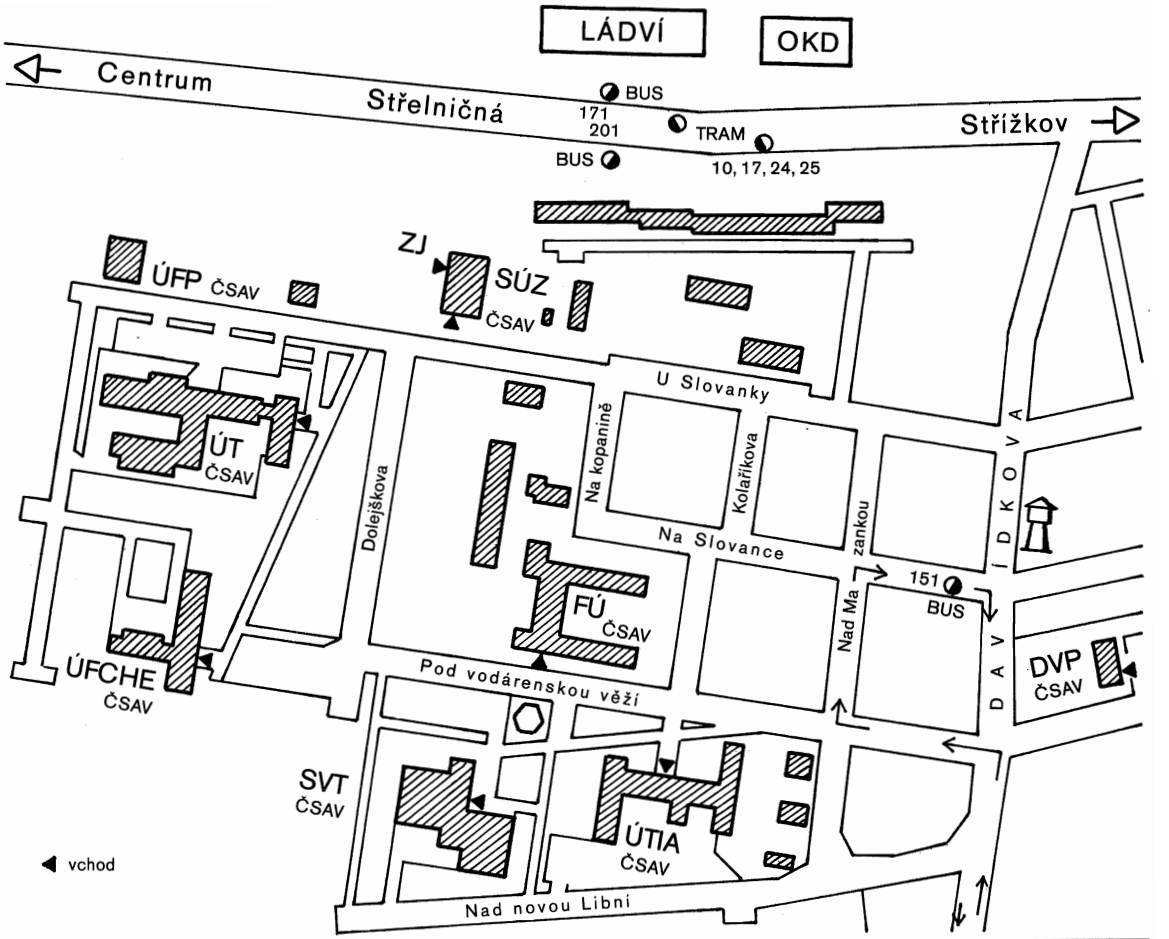
The Institute is also responsible for the training and education of postgraduate students up to the defence of the PhD Theses related to thermomechanics and fluid dynamics, and solid body mechanics.

Jointly with the Institute of Materials and Mechanics of Machines of the Slovak Academy of Sciences the Institute publishes a bimonthly journal Strojnický časopis (Journal of Mechanical Engineering), thus providing a medium for presenting new findings and results in engineering mechanics.

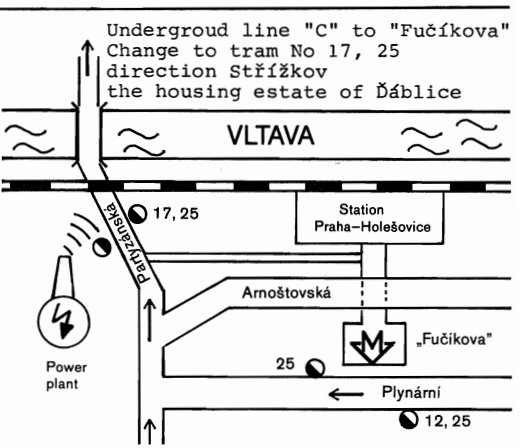
The extent of the Institute´s activity since its establishment may be documented by more than 960 research reports, 330 technical reports and by many other publications.

Many members of the Institute have been awarded various medals, prizes (including two National Prizes), and honorary titles for new achievements and outstanding contributions to the advancement of knowledge and technology. Professor Jan Jůza, Corresponding Member of the Academy and a collaborator of the Institute, has been awarded the "Honorary Fellow of IAPS" for his systematic and most important contribution to research and standardization of thermodynamic properties of water and steam.

WHERE WE ARE?



ÚT	Institute of Thermomechanics of the ČSAV
ÚFCHE	The J. Heyrovský Institute of Physical Chemistry and Electrochemistry of the ČSAV
ÚFP	Institute of Plasma Physics of the ČSAV
SVT	Central Computer Centre of the ČSAV
ÚTIA	Institute of the Theory of Information and Automation of the ČSAV
SÚZ	Administration of Supplies and Services of the ČSAV
ZJ	Canteen
LÁDVÍ	Shopping Centre, Services
OKD	District Cultural House



Campus of the Academy of Sciences
Praha 8, Slovanka