40 YEARS OF THE INSTITUTE

In 1995 the Institute wil1 complete 40 years of its existence. It is an opportunity to review its activities during all this time. The 40 years can be divided into several periods reflecting also both the political and economic situation of the country, and the world development of science and technology. The formation of the Institute's scientific profile was naturally influenced by the personalities in its staff and, mainly, in the leading positions.

Initial Period

The Institute started its activity on January 1, 1955 as one of the newly established institutes of the Czechoslovak Academy of Sciences. Although the Academy was based on the Soviet model, it also followed up with the ideas about the organization of Czech science originated in the middle of the 19th century. Sergej Djaďkov, one of the leading personalities of the Czechoslovak industrial research in electronics, was appointed Director. He brought with him a small group of experts from the industrial research of stable oscillators and precise frequency (J. Tolman, V. Kroupa) and another one active in application of random processes and statistical methods (A. Špaček). Moreover, a number of individual experts joined the Institute and formed research teams in the fields of circuit theory (M. Tuero, K. Janáč, S. Vojtášek), precise measurements (J. Karpinský, J. Jirmus), and electromagnetic wave propagation (P. Beckmann). Since the very beginning education of postgraduates took place. At that time the Institute did not have its own building and was located at several places throughout Prague.

As early as in 1956 the Institute organized the first conference presenting its results achieved in the wave propagation, random processes, and circuit theory research. A number of university and industrial research experts participated there, too. It was the very first conference on theoretical radio engineering held in Czechoslovakia. The Institute continued to organize similar conferences in the following years.

The staff of the Institute was gradually increasing; the first postgraduate students finished their study. In 1959 the group of researchers specialized in random processes left the Institute for the newly established Institute of the Information Theory and Automation of the Academy.

Besides the theoretical results, the Institute was successful in evaluation of the Doppler effect during the flight of the first Sputnik, and in the development of an electromechanic analogue computer for resonance transformations and a random principle computer that were presented at the World Exhibition in Brussels.

Period of Programme Stabilization

This period started in 1961 when the Institute moved into its own building, which was very important for the development of experimental research activities. Precise Time Laboratory was established and the first etalon in Czechoslovakia with a highly stable crystal oscillator placed in a temperature controlled well was built up. In 1963 in Quantum Electronics Laboratory ammonia maser (V. Trkal) as well as ruby laser (J. Blabla) started to operate.

In 1961 the first international conference on circuit theory was organized. Members of staff published the first scientific monographs and a number of contributions to special proceedings. The Institute was one of the organizers of the International Conference on Non-Linear Oscillations. Also the new results on application of the probability methods in electromagnetic wave propagation were presented on the international forum.

In the academic year 1963/64 the Institute together with the Faculty of Nuclear Physics (Czech Technical University) held a two-semester postgraduate course in quantum electronics.

Period of Changing the Research Orientation

In 1963 Václav Zima was appointed Director of the Institute and his appointment caused substantial changes in the Institute's structure. The Department of the Electromagnetic Wave Propagation was moved to the Institute of Geophysics and its head left for the U .SA. On the other hand, a part of the former Laboratory of Optics, engaged in the research of optical materials for IR spectral region (led by A. Vaško), was included in the Institute. In 1965 a department of the Institute of Physics, working in the research of electronic applications of ferroelectric single crystals, was transferred to the Institute (Department of Non-

Linear Dielectrics - Z. Málek). In the same year the laser opthalmocoagulator for eye surgery was designed and realized. The research in the field of the circuit theory was focused on digital signal processing and on computer aided design of electronic circuits using powerful computers (M. Novák).

Activities in microelectronic technologies started, especially transport effects and film layers were studied. The first samples of microelectronic devices and passive and active components as well as electroluminescent diodes were prepared.

In 1965 the Institute organized the Summer School on Circuit Theory which was very successful and took place regularly since then.

Experiments with the propagation of light in the open atmosphere were carried out (F. Hoff). They represented the beginning of involvement of the Institute in the field of optical communications.

In 1967 J. Tolman was the first in the world who proposed and performed a comparison of the time scales by utilizing transmission of TV synchronization pulses. This method soon became a standard worldwide and has been commonly used ever since.

Period of so called "Political Normalization"

The political changes after 1968 affected the whole Czechoslovak Academy of Sciences. Many staff members left the country and others lost their jobs. In 1971 the Department of Quantum Electronics and Department non-Linear Dielectrics were dissolved. The Academy concentrated on applications oriented projects. An applications unit was established in the Institute to produce small series of unique devices and components. Based on the modern principles of frequency synthesis, exciters for radio transmitters of the Czechoslovak broadcast network were designed and produced.

Since 1970 the Time and Frequency Laboratory has been operating a Hewlett-Packard caesium beam frequency standard. Czechoslovakia has become the first country behind the iron curtain possessing a frequency source based on quantum definition. Since then the Institute has been participating on the definition of the UTC (Coordinated Universal Time).

In 1975 the group engaged in computer-aided design of electronic circuits left for a newly established General Computing Centre of the Academy and M. Novák was appointed its director.

The Institute started a systematic research into optoelectronic materials.

Period of Material Research

Using the modified Czochralski method (for the first time in Czechoslovakia) single crystals of GaP were prepared in 1970 as a basis for the production of light sources for communications and imaging applications.

The experience acquired in laser technology enabled to start research in optical recording of information into various materials for optical memories.

The basic research in the field of holography (M. Miler) found a number of applications in Czechoslovak industry (holographic interferometry, diffraction gratings, and scanners).

The team engaged in the research of paramagnetic resonance was transformed into the Department of Semiconductor Physics. Its programme has concentrated on the research of physical characteristics of some $A^{III}B^{V}$ and $A^{II}B^{VI}$ semiconductors and their surfaces as well as on the technology of preparation of these materials. The SIMS (Secondary Ions Mass Spectroscopy) method was further developed (Z. Šroubek).

Period of Optoelectronics and Optical Communications

In the field of optical fibre communications the Institute developed methods of measuring transmission parameters (backscattering, dispersion) of both multimode and single-mode optical fibres. Further activities were directed towards automation of optical fibre fabrication processes. As a result a multiprocessor system using an on-line holographic fibre-diameter measuring device has been developed to control the drawing process of silica fibres.

In the field of guided-wave optics the research was focused on integrated optics elements for signal processing in optical communications and on theoretical analysis of wave propagation in planar and channel waveguides (J. Čtyroký). Experiments were carried out on dielectric materials (i.e. glass, electrooptic lithium niobate). The research on semiconductor radiation sources for optical communications

was concentrated on three spectral regions: 0.8 .Um (AIGaAs/GaAs), 1.3 μm, and 1.55 μm (InGaAsP/InP). The first lasers working in the continuous regime at room temperature in the region 0.8 μm were produced in 1981. Similar operation regime was obtained with the 1.3 μm wavelength sources in 1988 and a year later in the 1.55 μm band.

Period of Transformation of the Academy

The political change in 1989 and new economic situation had great impact on the structure of the Academy and resulted in great reduction of its staff. The number of employees of the Institute decreased by one third. In 1990 Viktor Trkal was appointed Director of the Institute. The emphasis of the Institute's activities was shifted back to the basic research with the aim to achieve the standard common in technologically advanced countries. The applied research was suppressed because of, besides other factors, the collapse of the Czech electronics industry. The international cooperation increased rapidly, resulting in participation of the Institute in a number of international projects.

The International Union for Scientific Radio Engineering (URSI) appointed the Czechoslovak URSI Committee, which has its headquarters in the Institute, to organize its 23rd General Assembly. This Assembly was held in 1990 and was organized by the Institute in cooperation with the Faculty of Electrical Engineering (Czech Technical University). It was the largest event organized by the Institute so far; more than 1.500 experts from 47 countries took part in it.

The current activity in the field of technology is concentrated on the research of sophisticated optoelectronic structures (e.g. laser structures with quantum wells), integrated optoelectronics and application of new non-traditional materials and technologies in optoelectronics and photonics.

In the field of telecommunication networks the universal access network architecture employing passive optics, intelligent active remote nodes and decentralized switching suitable for multimedia communication has been proposed. The idea of passive branch structure and multiwavelength optical transmission has been applied to network of continental dimensions.

The task in the research of spread spectrum digital communication systems is to design special codes and to analyze and optimize the receiving process.

Mathematical models have been used to analyze and optimize the parameters of optical fibre amplifiers on the basis of glasses doped with rare earth elements. The technology of preparation of these fibres was developed. Computer simulations are used to study the conditions for generating subpicosecond pulses in erbium fibre lasers.

In the field of the planar guided-wave optics functional elements for optical communications are being further developed, as well as modern measuring methods and optical sensors. The development of holographic diffraction structures is focused on the methods of transforming optical beams for optical interconnections in electronic circuits.

Since 1990 the speech processing laboratory has been dealing with text-to-speech synthesis with high intelligibility and naturalness (R. Vích) in collaboration with the Institute of Phonetics of the Philosophical Faculty, Charles University.

In the field of time and frequency, since 1993 the Institute has become responsible of the Czech National Time and Frequency Standard currently based on four caesium beam clocks. Through the use of the Global Positioning System (GPS) the traceability of the Czech Standard to the Coordinated Universal Time has improved down to nanosecond level.

In the electronic material science the semi- conducting and semiinsulating III-V compounds have been studied, in particular GaAs, AIGaAs, InP, and InGaAsP thin layers. Significant results have been obtained in investigation of impurities with metastable effects, above all EDX centres in $Al_xGa_{1-x}As$ that give origin to persistent photoconductivity near the liquid nitrogen temperature.

In the Department of Surface Physics in the frame of the semiconductor surface studies the mechanism for ion and electron emissions for particle bombarded III-V compounds has been identified both experimentally and theoretically.

In the middle of 1994 the office term of director Viktor Trkal expired and Jan Šimša became new director of the Institute.

* * *

The results of the research activities are currently published in international as well as domestic scientific journals and conference proceedings. Almost 1.100 original papers in foreign languages and 92 monographs (21 in foreign languages) have been published by the members of the staff of the Institute since 1955.

During the elapsed forty years the Institute has proved its right to existence among the institutes of the Academy and has gained a respectful professional position in industrial sphere and academic community. It has become a recognized partner of a number of foreign scientific institutions and a participant of successful international projects.