Mathematical Machines at ČSAV

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Abstract

Mathematical machines, also called information processing machines, or nowadays simply computers, had their place in the Czechoslovak Academy of Sciences since its foundation in 1952. Antonín Svoboda, the Czechoslovak computer pioneer, started developing the field on a less formal level already in the late 1940s, having spent the war years designing computers at MIT in USA. However, although constructing a Czechoslovak computer was declared to be a priority of ČSAV and although Antonín Svoboda's team was working hard on the design, the computer designed in 1951 was eventually put into operation after a lengthy procedure in September 1957. Albeit SAPO, the first Czechoslovak computer, could have been described as a success on several levels, its chief designer and his team were expelled from ČSAV soon after SAPO had been put into operation. On one hand, this meant greater flexibility and more intensive contact of the Research Institute for Mathematical Machines (known as "VUMS" in Czech) with the computer building industry, but on the other hand, since its exclusion from ČSAV, the Research Institute for Mathematical Machines focused less on the theoretical issues pertinent to computer construction and related fields.

1. Introduction

In 1938, Antonín Svoboda (1907-1980) and Vladimír Vand left Czechoslovakia on the eve of World War II, with the plans for an aircraft detecting device in their luggage and in their heads. They were asked to use this device against Hitler anywhere in Europe. They first stayed in France and, after France had been occupied, left for the USA (Svoboda) and England (Vand). In the USA, Svoboda worked on the design of computers at the Radiation Laboratory of the Massachussets Institute for Technology. Svoboda published his *Computing Mechanisms and Linkages,* describing the wartime efforts at MIT, in Prague in 1946. After World War II, Antonín Svoboda came back to his home country with the dream that Czechoslovakia would become a superpower in computers, just like Switzerland was a superpower in watches. To this end, Zdeněk Trnka and Antonín Svoboda went for a scientific trip to England and the USA in 1947, to make themselves acquainted with the latest computing technology. Upon their return, Trnka started working towards setting up a new course at technical university. Svoboda taught a course in this programme, the one on mathematical machines. In 1950, Eduard Čech (1893-1960) agreed to take Antonín Svoboda and his devoted students under the roof of the Academy of Sciences and Arts (ČAVU). This structure was repeated also in the Czechoslovak Academy of Sciences (ČSAV), founded in 1952 and following the Soviet model of academy of sciences containing research institutes.

2. Department and laboratory for mathematical machines

From the very beginning, the department for mathematical machines formed a self-contained

unit. In 1953, an unsigned report on the history of the individual institutes at ČSAV claims that "apart from the departments for theoretical mathematics, elementary mathematics, mathematical statistics, and technical mathematics, this institute also contains the department of information processing machines, which is thought to be a candidate for becoming independent under the name Laboratory for mathematical machines".[1]

In December 1952, the first conference of the department for mathematical machines was held in Liblice and was the first in the line of the annual *Symposia on the information processing machines.* The design of SAPO was presented to the participants and was also published in the first volume of the proceedings. The participants formulated the following resolution:[2]

"The participants of the conference on information processing machines were informed about the importance of this discipline in the Soviet Union and about the work done by the group of his department for information processing machines. They were convinced that:

1. Employing information processing machines will speed up the solving of many theoretical as well as practical tasks, of which some are virtually not solvable by the methods currently available.
2. Employing these machines will mean the possibility to save human workforce, material, and improvement and substantial increase in the productivity in many areas of technical as well as scientific work.
3. From the above-stated reasons, the primary economic importance of information processing machines follows.

The participants of the conference acknowledge that the problem of the information processing machine construction is solved very well from the theoretical point of view, but the practical manufacturing of the prototype has not been secured yet.

The participants of the conference have unanimously come to the conclusion to ask the Czechoslovak Academy of Sciences
a) to support with all its might the work of doc. Svoboda and his colleagues in the sense that the group mentioned had a potential for further growth,
b) to ask support, at the relevant ministries, for the production plants and research institutes for the realisation of information processing machines and that these tasks were assigned appropriate importance,
c) to support the development of this wholly new area of mathematics at universities by introducing suitable lectures on the discipline."

At the same conference, Svoboda also stressed that "it is high time to inform the interested people about the code (of the new computer), so that they can predict which of their problems are suitable for the machine and which are not."

The Laboratory for mathematical machines became an independent body of the Czechoslovak Academy of Sciences on April 3rd, 1953 on the basis of the agreement between the director of

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[1] Masarykův ústav - Archiv Akademie věd (Further abbreviated as AAV), Fond: I. (matematicko-fysikální) sekce ČSAV 1952-1961. Karton 4, Inv. No. 6, I. sekce všeobecně.
[2] *Časopis pro pěstování matematiky,* **78:** 30, 1953.

the Mathematical Institute, Eduard Čech, and the future director of the newly established Laboratory for mathematical machines, Antonín Svoboda. This agreement is explicitly mentioned in letters by Čech and Svoboda from January 1953.[3]

SAPO is repeatedly mentioned in various reports on the research and development performed in the 1st section of ČSAV. Mathematical or information processing machines are even mentioned, when the importance of mathematics education and expertise is advocated. For example, in October 1954, Vojtěch Jarník writes the following resolution to the conclusions of the Czechoslovak Communist Party gathering,[4] trying to show the importance of mathematics and physics for the technical sciences, and thus also for the industry:

*"Special attention should be paid to the tasks that are exceptionally important for national economy, whose realisation and use in practice will not be possible without the support from the highest institutional bodies. These are especially the study of low temperatures, the study of semiconductors, **finishing of SAPO**, and in future the tasks of nuclear physics.*

*When introducing these into practice, we often encounter difficulties caused by insufficient flexibility of planning in exploiting the new findings. This is true e.g. for the spreading of the **production of mathematical machines,** the production of semiconductors, parts, instruments, etc. It would also be good if the research institutes and big enterprises could rely in solving their problem on their own scientifically educated mathematician."*

Jarník obviously concludes his resolution with the appeal to the increase of the numbers of students allowed to study mathematics. Probably at the same time,[5] in the review of the state-of-the-art of the individual scientific branches, an anonymous author comments on the turn from pure to applied mathematics and also emphasises the importance of numerical methods, "without which it is in practice not possible to finalise the computations based on theoretical mathematical results".

From the very beginning, Svoboda was asked to take part in trips abroad. He was for example asked[6] to visit Poland by the rector of the University in Warsaw, Tursky. Interestingly, the journey was justified by the fact that Poland was in possession of western books that Czechoslovakia could not obtain.

3. Institute for mathematical machines

On February 11, 1955, the Laboratory was transformed into an Institute for mathematical machines, and the travelling continued, although the journeys had to be consulted with the presidium of the Academy of Sciences, which sometimes resulted in cutting down the number of people going abroad. Antonín Svoboda was chosen to go to the Soviet Union to develop relationships with Soviet professionals in computing. He himself was not so pleased with the

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[3] AAV, Fond: I. (matematicko-fysikální) sekce ČSAV (1st (mathematical and physical) section of ČSAV) 1952-1961. Karton 10, Inv. No. 22, Mathematical Institute.

[4] AAV, Fond: I. (matematicko-fysikální) sekce ČSAV (1st (mathematical and physical) section of ČSAV) 1952-1961. Karton 4, Inv. No. 6, 1st section in general. Emphasis mine.

[5] Ibid.

[6] AAV, Fond: I. (matematicko-fysikální) sekce ČSAV (1st (mathematical and physical) section of ČSAV) 1952-1961. Karton 21, Inv. No. 67. International relations - General - Plans - Evaluation.

idea of following Soviet computing, or at least he remembers so later.

The continuing concern of mathematicians with mathematical machines is also reflected in Kníchal's report on the development of mathematical analysis:[7] "The issue of an automatic computer is still not solved, which is connected to the issue of adjusting numerical methods for machines and to the issue of sufficient use of the machine."

Kníchal argues with the requirements of the practice at this instant, and not without a reason: the Mathematical Institute was frequently presented with tasks of computing for construction project, e.g. for the dam *Orlík*. However, no matter how ardently and frequently the topic of mathematical machines was mentioned, the design dating from 1951 finally took shape in an operating machine, the famous SAPO (SAmočinný POčítač) six years later, in September 1957.

As the archival sources show, problems with the construction of SAPO were most probably taken as an excuse to get rid of Antonín Svoboda. Several times between 1955 and the exclusion of the Institute of Mathematical Machines from ČSAV in as of April 1st, 1958, the officials from the presidium of ČSAV came to check the state of affairs of the works on SAPO. Ultimately, it was probably the television programme on SAPO in March 1957, featuring Antonín Svoboda as its chief designer that provided the presidium with clear evidence with which to scold Svoboda. Namely, the use of present instead of future tense was criticised: future tense should have been used to show that SAPO has not been finished yet. Also, Svoboda's ideas presented in the programme as to in what direction computing technology should develop were criticised.[8]

In parallel development with this, the presidium of the Academy of Sciences was also trying to secure more Soviet influence on the computing in Czechoslovakia. For example, they asked Academician Lebedev to come to Prague and to judge the development of the work on SAPO. Also, instead of supporting the development and production of computing technology in Czechoslovakia, the presidium asked the institutes to express their needs concerning computing and, on the basis of these, decided to buy the URAL computer from the Soviet Union.

4. Conclusion

The role of mathematical machines in Czechoslovakia of 1950s can be juxtaposed to the role of computers elsewhere in Europe. It seems that nowhere the computers were introduced without some special rhetoric. Often, the issue of being backward in comparison to some other country was brought up as an incentive for investing more into computers. In the case of Czechoslovakia, like in the case of other Comecon countries, computers were also taken as an important technology to demonstrate success and advancement.

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[7] AAV, Fond: I. (matematicko-fysikální) sekce ČSAV (1st (mathematical and physical) section of ČSAV) 1952-1961. Karton 4, Inv. No. 6. Meeting of mathematicians, March 30, 1957.

[8] AAV, Zápis z jednání výboru presidia ČSAV, June 19, 1957.

References

[1]   Masarykův ústav - Archiv Akademie Věd. Fond: I. (matematicko-fyzikální) sekce ČSAV. 1952. 1961. Details on the references are given in footnotes.

[2]   Masarykův ústav - Archiv Akademie Věd. Fond: V. (technická) sekce ČSAV. 1952. 1961. Details on the references are given in footnotes.

[3]   Masarykův ústav - Archiv Akademie Věd. Fond: Zápisy zasedání presidia ČSAV 1952-1958. Details on the references are given in footnotes.

[4]   *Stroje na zpracování informací.* Proceedings of the conferences of the Department, laboratory, Institute, and Research Institute for Mathematical Machines. **1-22**, 1953-1982. Details in footnotes.

[5]   Oral history interview No. 35 with Antonín Svoboda, conducted by Robina Mapstone in November 1979. Charles Babbage Institute (available online).

[6]   Gerovitch, Slava, *From Newspeak to Cyberspeak. A History of Soviet Cybernetics.* MIT Press, Cambridge, Mass., and London, England 2002.