Professor Heinz Zemanek

Reminiscences of the work in Switching Algebra

Radomir S. Stanković, Milena Stanković

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Preface

Every student and scholar working in the field of Computing and Cybernetics knows the name of Professor Heinz Zemanek, a computer pioneer, (as recognized also officially by the IEEE Society in 1985), who built the first fully transistorized computer, father of Vienna Description Language, founder and leader of the Vienna IBM Laboratory, etc. The list of duties of Professor Zemanek serving in the computer community during many years is so long that it is hard to enumerate all of them at once. It is the same with a record of honorary degrees, special awards, and distinctions of Professor Zemanek,

We had pleasure to see Professor Zemanek for the first time at the occasion of an EMCSR meeting many years ago in Vienna. We always wanted to ask him to tell a bit more of his reminiscences of the early work in switching algebra in Europe and Austria in particular, and have been looking for such an opportunity. We asked Professor Franz Pichler to make contacts and convince Professor Zemanek to devote some time to such a conversation as a kind of an interview.

This meeting with Professor Zemanek in June 2009 was a wonderful lecture given to us on computing and cybernetics, a memorable walk through history along a

promenade through Vienna, from the offices of the Austrian Computer Society, across the Stephansplatz, and further to the Vienna University of Technology. The highlight of this lecture from history was in the office of Professor Zemanek, actually two big rooms forming a treasury preserving a very valuable collection of documents, articles, papers, and books recording the development of switching algebra, computing devices, programming languages, etc.

This booklet is a record of these talks with Professor Zemanek. Although it mainly reflects our rather personal impressions, we believe it can be interesting for anyone reading in history of computing. Therefore, we took the liberty of offering it to the public notice.

Radomir S. Stanković, Milena Stanković
Niš, Serbia July 2010

Acknowledgment

The authors are very grateful to Professor Franz Pichlcr for the arrangement of the meeting with Professor Zemanek and for the great help in conducting the interview with him. Without the help of Professor Pichler realization of this nice event resulting in the present booklet will be impossible.

We also thank Professor Pichler for the advices and corrections in the presentation in the booklet.

Photos used in this booklet were taken by F. Pichler and R.S Stanković.

An excellent historical overview of Switching Algebra can be found in

Zemanek, H.f "Logische Algebra und Theorie der Schaltnetzwerke", in Steinbuch, K., Weber, W., (eds.), *Tasckenbuch der Infonnatik*, Band 2, *Struktur und Programmierung von EDV-Systemen*, Springer, 1974, 1-63.

The conversation started when we presented to Prof. Zemanek a book about the contributions of the Japanese scientist Akira Nakashima to Switching Theory. Akira Nakashima is the author of the first paper ever published in Switching Theory in 1935.

Zemanek: Japanese were ahead with the switching algebra and this is the reason why Japanese could develop computers without copying. You know, we normally say that the Japanese travel around make photographs and then they go home and copy. But, it is not so in the case of relay computers, because in this case they have their own basis at home and they could simply proceed and go ahead.

At the beginning I have met Hanzawa, and there is another name that I have met, Eiichi Goto, I guess.

Zemanek: Let me start from the very beginning. You touch switching of course if you are an electrician. 1 can tell you a story about my early days even as an entrepreneur. In War time I was in the radar research in the German army, Luftwaffe essentially. At the end my post was over, and I could not dare to go to Vienna because of the danger of Russian urgent invitations was too big. I knew about colleagues who knew much less. There were the things. They came back afterwards and then I went back to Vienna.

At the beginning I decided that I have to stay in the American zone of Germany. I had already been working in the area of Ulm. Therefore, I stayed in a little town near Ulm and open a kind of business doing electricity and radio repair and things like that. It was a nice life relative to the time, because when I did something for a fanner, there was something to cat. And there is my first story on switching algebra.
You know that the Alemannic people are famous for being very "sparsam" how is that in English?

Pichler: "low cost oriented".

Yes, this is a nice way of put it. I came to an apartment and I tried to repair it. After 1 finished, the problems were with fuses and 1 was wondering how is that possible. It should be absolutely impossible, until I discovered the logic. They saved one wire by doing the following. Imagine an apartment which is a chain of rooms. You have the entrance where you can go all the way through. There is a door and at every door there is a switch that goes in both directions. Now, instead of doing that in a normal way, as we are used to, they had only two wires and a light source was attached either up or down, can you imagine. Therefore, they did not need a constant further wire. They had only two, and that was my first insight in a switching process.


Reprints from the Early Days of
Information Sciences

In this switching you have not so much to do, I had to do that from another point of view and this is the telephone switching of course. That was the switching of relay fields.

1 was engaged still during the War by a Viennese author who wanted to write a book about the telephone switching. And he wanted to have something which is very intelligent, the first reader. Somebody who understands a little bit, but not too much, an average reader of the intended book, and 1 was obliged to ask questions for what I did not understand or what I felt there is something wrong with your text, or so, or your drawings. And he had a particular idea for telephone switching. I can show you the book, I still have it, and I was introduced by this way very elegantly and without too much effort in telephone switching. I passed at the examination at the University like nothing, it was no problem.

This idea was the description of the switching processes in a time diagram. So you are not yet on the real bit orientation. It is not yet what we call today digitalization. But it was a *Yes - No* process over analog time. And you know what the telephone people at that time did? When you have the dialing wheel you had to distinguish between the next pulse expressing the time modulo 6 and the end of the series and jump to the next stage. That he did with very intelligent diagrams and 1 learned of course a lot about the procedures which were built-in. With that knowledge, I approached one day of course the digitalization.

The other way of me personally was that I tried to escape, you know, the army. And 1 managed to do so and 1 got a paper to call me back one to lower Austria and one to Silesia. You can easily guess what I accepted. I went to lower Austria. There was a man who was a captain, technical rang, and he had a great idea, he wanted to make a tank to tank communication and he would use so short pulses that enemy does not hear. When I answered, "The enemy will hear you because you do not have such a

large bandwidth, and if you have the small one, they gets you quite easily, and then your short pulse does not help at all. So I saved him from blamage and he then helped me to get out there. That was over and I was for two months or so in Berlin, but you can imagine that Berlin in 1944 was not just a pleasant stage to be. By the way, I measured an aircraft attack to Berlin in terms of falling particles. Because you can easily guess that the heavier particles fall down first and the lighter later become down. The German army, Luftwaffe, had the idea of having projectiles to be shouted and with a bridge (electrical) and if it comes to the neighborhood of an aircraft the bridge goes out of the equilibrium and then the explosion. So, it should heat the aircraft. Fine, and the question was which frequencies are the best for this arrangement. We were charged to make measurements of radiation. So 1 build up in an interesting place.

Do you know Berlin a little?

Yes I have been there.

You know the Havel river?

There is a gato (a kind of submarine) on one side which was our institution, and on the other side is everything green and a little cover. We established an interconnection, and when the heavier things come down, the longer waves were disturbed and when the smaller ones come down, it shifted from longer to shorter waves. That was nearly a joke. I have found that the whole thing is not adapted to me, also as far as the working conditions are good.

Oh, yes, I should tell you the following story.

I was there at the *Institute for Acceleration*. What you think, that this is? Very difficult to guess, but very easy to explain if you go back to the V1 time. You needed an electronic equipment that can stand very sharp accelerations. So the task of the head of the Institute was to collect simply knowledge how do you built circuits that can stand it. And he was a physicist and he said "First I have to know what is an acceleration". For this purpose he shoots two anti-aircraft guns against each other. Can you imagine? Very hard, but for a physicist this is not much of a problem. How thick has a tube (electronic vacuum tube) to be so that it can stand the experiment and with a special number in the system at that time, he really got it done.

And I come there when this was already established. You could press a button and you have a sound and the two things were against each other, press the air inside of an incredible distance, and bang. The boss wanted me to measure the epsilon e, that is the density, and the distance. I said, "Sehr grehrter, Herr Professor, with one equation I cannot resolve two unknowns. And he denied that. So, I said "No". This is why I got to the other division, to the wavelengths measurement, because we could not understand each other. Then I went to my friend and said 'There is nothing for me that I must stay. Moreover, I want to finish my diploma before the end of the War. So, I asked to be moved to Stuttgart.

Do you know Professor Terkela? He was one of the German specialists for filter and quadruples theory (in German vierpoltheorie). He was already in flight, because the Institute was already bombed, so he was outside of the city. For me it was fine. I was in the Institute in Ulm, the Central Institute for High Frequency Research under the leadership of the Professor also. It was permitted to go 100km. I have found a way to get somebody to bring me to the railway and then I made 94km and I have found somebody to visit the Professor. And I slowly wrote my Diploma work which was on the production of microsecond impulses.

So that is the end of this part of my life. The War was over and I was in Ulm, and I had to stay there naturally because going to Austria was too dangerous at that time.

How did you eventually come to Austria after this time?

Zemanek: Truck, train going from Augsburg to Vienna. So 1 returned in February 1946,1 came back to Vienna.

Pichler: Concerning Hansi Piesch?

Zemanek: I am not yet there. But it is a good question. She was an employee to the PTT (Post Telegraph and Telephone) and she came to the idea of switching. Now there is, however, a forerunner. 1 must slowly explain, you know, this shift for me is very long back to that time. There was a Professor called Edler, That is the very first pioneer for switching in Vienna. Robert Edler. He had a son who was also around in the field but not very long, he died relatively young. But Robert Edler did switching. I will show you then some of the material. And she was in connection with him, but she worked at the PTT and she got interested in switching algebra and she wrote a couple of very original papers. Say two or three, I will show you what I have. Then the next one is Duschek. Duschek is only a mathematician, he looked for the correctness of the formula used, but he was not really interested in switching.

And what was his name? Adalbert Duschek?

Zemanek: Yes, I think so. You will get documents. We could slowly move to the University.

Zemanek: Yes, you can get a copy of the original paper by Duschek, but if you copy all the material you are here for a year.

Nicht im Handel

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Über eine neue Art von algebraischen Bereichen.

Von
A. Duschek, Wien.

Mit 15 Abbildungen.

(Eingelangt am 1. September 1945.)

Einleitung.

Unter einem algebraischen Bereich verstehen wir eine Menge von mathematischen Objekten, in der zwei, in der Regel Addition und Multiplikation genannte und innerhalb der Menge unbeschränkt und eindeutig ausführbare Operationen definiert sind. Die im folgenden eingeführten und als *Klassen* bezeichneten neuen algebraischen Bereiche unterscheiden sich von den Ringen und Körpern vor allem dadurch, daß weder die Gültigkeit des distributiven Gesetzes noch die Umkehrbarkeit der beiden obigen Operationen, oder auch nur die der Addition allein gefordert wird. Anstelle dieser Forderungen tritt vielmehr hier die in § 1 aufgestellte Forderung IV, die von gänzlich anderer Struktur ist als das distributive Gesetz oder die Umkehrbarkeit von Addition oder Multiplikation, sodaß die Klassen sich recht wesentlich von den Ringen oder Körpern unterscheiden.

Da die erwähnte Forderung IV sowie die vorhergehenden aus zwei Teilen besteht, die sich auf Addition und Multiplikation beziehen, herrscht in den Forderungen eine völlige Symmetrie zwischen den beiden Operationen, sofern man nicht auf Teile dieser Forderungen verzichtet, wie wir das im folgenden für die Forderung IV mitunter machen werden. Um eine Klasse völlig zu bestimmen, muß noch das „Einmaleins" der Klasse angegeben werden, d. h. eine Reihe von Vorschriften, welche zu je zwei vorgegebenen Elementen der Klasse deren Summe und Produkt anzugeben gestatten. Herrscht auch hier eine volle Symmetrie zwischen Addition und Multiplikation, so besteht in der Klasse eine

Zemanek: Pleehl (Otto Plechl) was the guy who really went into switching.

What was his profession?

Zemanek: Pleschl was a kind of extraordinary professor at the University of Technology and I got interested in the work he did, but he was not very much interested in me. I was interested in him and I knew bow to arrange all of that. I came back to the university in 1947.1 told you I came back to Vienna in 1946,1 tried to start my own company. One idea for instance was that we were a little bit experienced in radar technology and one idea was to apply radar technology for blind. Blind people who have to go and get a little machinery and they will find obstacles on their way. Until I found out in the literature the following truth. If the guy kept searching and he goes through parks the first run is double as fast as somebody who goes only with a stick and then the guy with the walking stick can learn, the guy with the machine cannot learn. Moreover, you get the following problem, if you make the beam very sharp, then you can easily overlook reflection if you move it too fast the very same thing would not answer. On the other hand, if you make it too large, you have no exact measurement and it does not help very much and all over you do not learn and, therefore, the guy with his own sound is still the better one, more successful. So I recognized this was no a feasible approach. We did a little nevertheless.

One of the other things we looked at was a tube (electronic vacuum tube) testing machine. That was an important task because at the end of the War new tubes were hardly available and you had rarely to see how good are they. But still I saw that this was not my future, moreover, probably, I did not have the necessary character features to become an entrepreneur. Yes, that was an additional reason.

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Grundzüge einer Algebra der elektrischen Schaltungen.

Von **O. Plechl** und **A. Duschek**, Wien.

Mit 29 Textabbildungen.

Übersicht.

Die vorliegende Arbeit zeigt die Möglichkeit einer rechnerischen Behandlung der elektrischen Schaltungen, die allerdings erst die Entwicklung eines im wesentlichen völlig neuen algebraischen Kalküls erfordert. Nach einer Definition der Grundbegriffe in 1. werden die Grundlagen des Kalküls dargestellt und an Beispielen erläutert. Zum Schluß (11.) wird noch auf den Zusammenhang mit dem Aussagenkalkül der algebraischen Logik eingegangen.

Elektrische Schaltungen sind die Verbindungsglieder zwischen Stromquellen und Verbrauchern, worunter wir alle elektrischen Maschinen und Apparate verstehen, in welchen eine Energieumwandlung stattfindet. Die Aufgabe der Schaltung ist es, gewisse Gruppen von Verbrauchern an gewisse Gruppen von Stromquellen anzuschließen oder sie von diesen abzuschalten, d. h. also, gewisse Strompfade herzustellen oder zu unterbrechen. Die Strompfade müssen vorgeschrieben sein, mitunter ist auch vorgeschrieben, daß die Herstellung oder Lösung der Strompfade von bestimmten verschiedenen Stellen aus zu erfolgen hat. Ein einfaches Beispiel hierfür ist die Wechselschaltung, bei der ein Verbraucher (Glühlampe) von zwei oder mehr verschiedenen Stellen aus ein- oder ausgeschaltet werden kann. Aus diesen Schaltbedingungen, die den gegebenen Ausgangspunkt bilden, hat dann der Konstrukteur die Schaltung selbst, d. h. ihre graphische Darstellung, das Schaltbild zu ermitteln. Der Weg dazu bestand bisher ausschließlich im Probieren, wobei natürlich dem Konstrukteur seine mehr oder minder große praktische Erfahrung, seine Routine, zu Hilfe kommt. Irgendeine Systematik, ja auch nur der Ansatz zu einer solchen fehlte bisher vollständig, wenn man von den Ansätzen von Edler[1] und Lischke[2] absieht, und daher war man

[1] R. Edler: Der Entwurf von Schaltungen und Schaltapparaten (Schaltungstheorie), 2 Bände. Leipzig. 1905 und 1927.
[2] Lischke: Schaltlehre. Leipzig. 1921.

The father of my colleague wanted to help his son to be boss and the big man, so ok. He ended by going to America and I moved back to the University after a year of all kinds of attempts, not all kinds of, several attempts. And that was of course an excellent idea because you stay in general in low frequency technology, high frequency somehow never really played a big role in my life. And I have an argument for that and that argument says I never could understand how a wave goes off the antenna. Nobody could explain it to me and then I said that is not an area for me, I will stay with low frequency but with short parts. I still had a large fun. But in general, so much during the wartime had to be neglected because you could not prove that it was important for the War, because also in other countries the war pressure made one-sided developments and it was a large field and you could do so much. And I started the use of the diploma works for understanding things. You know this is like to say if you want to understand the subject in full, you give a lecture. Because then you have to sit down and then you sec on the echo on the reflection on the reaction of your students whether you are yourself clear or not and that helps a lot. So there was the full area of war development, filter technology and so on, and so on.

Pichler: But you came after so many years later to switching?

Zemanek: True.

Pichler: This was the main idea that Zemanek is a synonym for the schaltalgebra (Switching algebra in German. There was no one around I think at that time anymore, at the University working strongly in this area?

Zemanek: And that was my way into digitalization. I started with the virtual pulses and you would not believe I mean, at that time, you know how I produced short pulses? I started with a sine wave, and then with a sine generator, put them on say

100 kilocycles and then I would know on the oscilloscope this was the length of ten microseconds, and when I could really produce a pulse which is only a tenth of that length, then I must have a microsecond. And that is today the argument to say "I cannot imagine a microsecond" because what I do there is a calculation and not really an idea of what a microsecond is. We work now at picoseconds (10-12 of a second) and even femptoseconds (10-15 of a second).

Pichler: May I just add a story' of my own? When I was in 1975 in Binghamton, Grace Hopper was giving a lecture. She was a famous scientist, Grace Hopper. She came in her navy uniform and while finishing her lecture, she took a piece of wire and says this is a microsecond.

Zemanek: I came first to America in 1957.

At Harvard, for this famous switching theory workshop organized by Aiken (Howard H. Aiken, Head of the Harvard Laboratory of Computing)? That is very interesting, and I found your name in the list of participants.

Zemanek: And I got a room by Professor Aiken for four dollars a night. Somehow the ceiling came down.

Pichler: Was it somewhere in suburban?

Zemanek: No, no somewhere in the downtown, but for me that was fantastic, with the little money I had.

And what is your impression, do you remember some of participants?

SWITCHING THEORY IN SPACE TECHNOLOGY

EDITED BY

HOWARD AIKEN

AND

WILLIAM F. MAIN

1963

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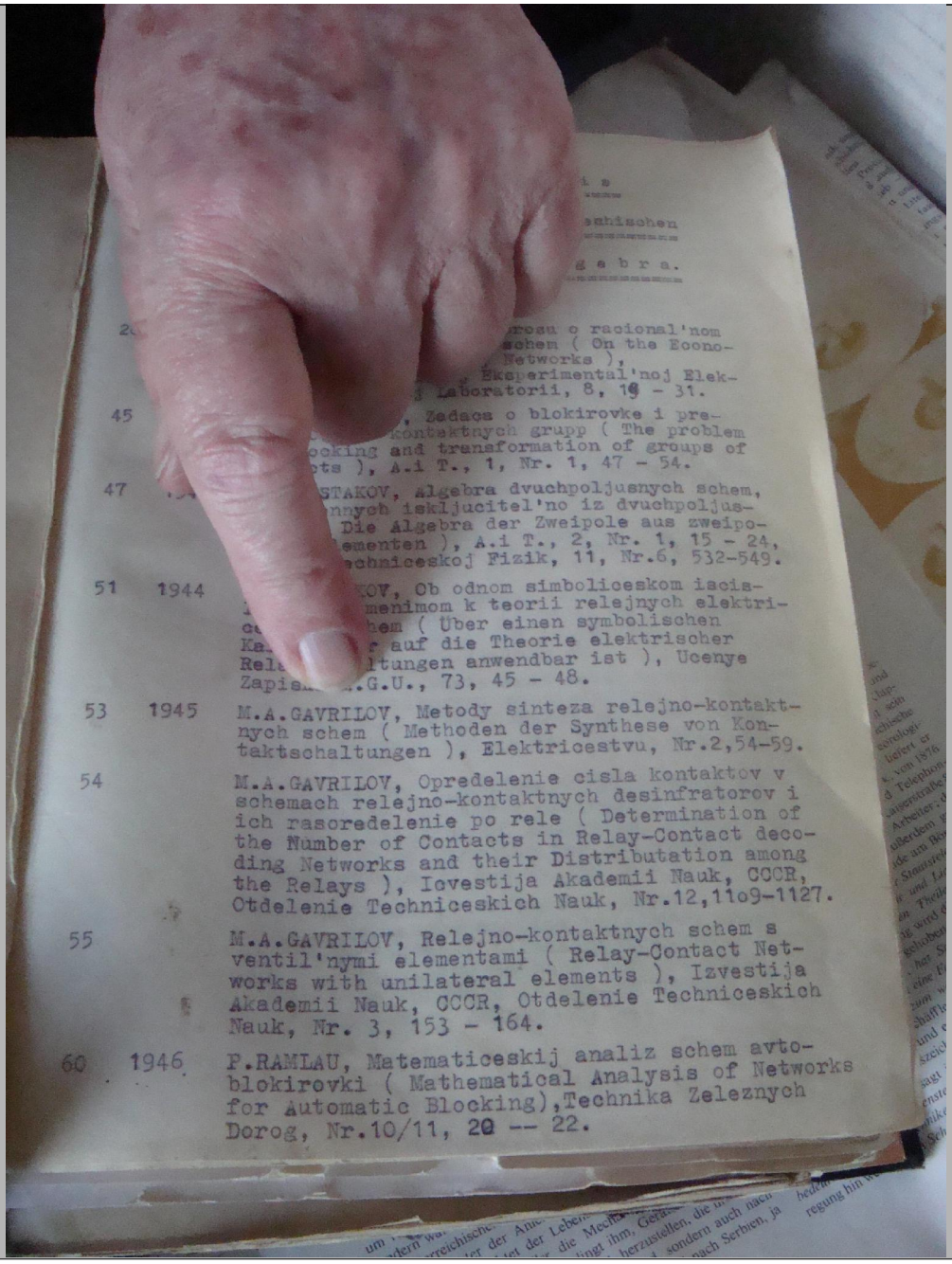

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Zemanek: Sure, step by step I met all the pioneers in America and I myself am appointed by IEEE.

1 am very proud that one of my supervisors, Professor Djuro Kurepa, gave a lecture on Logics, Sets, Machines, it is in the proceedings of this Workshop.

Zemanek: What is his name?

Djuro Kurepa.

Zemanek: Kurepa, Yes.

He was a mathematician. The title was Logics, Sets and Machines and he was already in the age of 77 when he accepted to be the president of the defense committee for my master and later in 1986 for PhD thesis. So I was really proud but he was murdered at the streets of Belgrade in this crisis time in 1993.

And what is your impression about Aiken?

Zemanek: Aiken? Aiken was, I like to say, he was the first architect in the field. In other words, his strength was design and he was much more interested in design of computing structures than in anything else. But, whatever he did he had money enough. Do you know when he started his first machine that was in cooperation with IBM? So, money was not really a question. And whatever he did he came more than once to Europe to give talks and so it was interesting, it was fascinating, it was encouraging, but you couldn't use it. It was either too expensive, too complicated. Also you know also that he somehow developed his own switching algebra. If you look on his papers, I think that really it was successful. But he had his institute and he was very friendly, and very helpful, not only with my room

but very generous, I liked him very much. The more important conference was then in California, in switching. But let us finish the story, to a certain degree. So I was first time in USA in '57, then I came back I think in '59. In '60 I was first time in Moscow.

That is also very interesting because I think you met many researchers there.

Zemanek: I met people. I knew Gavrilov who was my friend and there are several other Russian scientists whom I visited in their offices.

Did you meet Povarov?

Zemanek: Povarov? I think **I** met, but you will get all the names. That was Moscow, and they had asked me, but this is side issue, they had asked me whether I
would like an invitation to one of the Federal Republics, I mean one of the Soviet Republics and I was not prepared. I should have said Armenia, because the Armenians had big computers, but 1 only had the idea to see Gruzija, this is Georgia
in English and I spent some ten days or so in Georgia. I flew over the mountains there and had interesting visits. I was in Tbilisi of course, but there is a little town which I visited, lots of adventures.

What was the way to travel across Georgia, Gruzija? How did you travel, by car, by bus?

Zemanek: No, by aircraft. Over the, what is the name of the mountains, yes Kavkaz. I am getting old. It was impressive to look down over the mountains.

Pichler: I think we had also another topic, this is a side topic but we are together mainly because of Walsh functions. Because Dr Stanković did some work very important on this subject.

Zemanek: If we take that ahead, I also looked at that. I did not know even the name, but when the point was this, my computer was important because that made my name in the way and so on and so on. It was never the only one, because in parallel I developed the cybernetic models and we also programmed cybernetic models on the computer and so on.

Pichler: From Russia, your returned to Vienna. I believe you know Harmuth also? 1

Zemanek: Harmuth is my student. But then it was the following. You know, I encouraged him, he had a particular way of calculation. But then he opposed to follow my advices, and I said, "Fine, if you do not need me, it is good". And he constructed a computer which depended of a certain switching device so that the same computation you could operate on different places. What he did not consider enough was this moving part of it and he realized that it did not work.

Zemanek: And he had one of my students as diplomant. I did not care very much, I lost connection to him, he was not interested. Which is not the rule. Most of my students in America, I am partially even today in connection with them.

1 **Henning F. Harmuth,** Austrian origin scientists, a pioneer in applications of Walsh functions.

And how about this Vienna group when you stalled PL 1 projects?

Zemanek: I started with the computer. I had a number of students who did all the interesting work. I can give you a list of the diploma works 1 have supervised.

That is very important.

Zemanek: But the real kernel of this group started with the development of the Mailufterl (Austrian German word for May Breeze, a kind of joke and word play with the name of the famous computer Whirlwind (Typhoon) developed at MIT in the period 1945 to 1951).

Mailufterl was the first computer working on transistors. The official name of the computer was *Binar dezimaler Volltransistor-Rechenautomat* (binary decimal fully transistorized computer). And these people then went with me to IBM, forming the IBM Vienna laboratory. There we took the task, not to have the responsibility for Pl1.

I consider that as a misconstructed mammoth, but lire task is to transform the verbal description into a formal description, Including not only syntax, but also semantics. In other words, with our definition it is well defined what a computer makes out of a PL1 written program. That was the idea. At that time there was no method for doing that. What we created, that was the *Vienna Definition Language* VDL, a name which was created in America, not in Vienna. I had somebody who wrote about this Viennese method. That was a real step forward. What the hope was it did not come in, namely that IBM sees not the need, but the utility, the value of such a development, and to develop all the languages in view of a formal definition method so that you can use it in simple conditions. But you know, how can you deal


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AKADEMIE
HISTORY OF COMPUTING
INTELLIGENZBESTIEN INTELLIGENZBESTIEN

with a company that has an expensive research?

Have you ever been in Yorktown? It is fantastic. Already the building is impressive, it is a Saarinen (Eero Saarinen, a Finnish architect) building. I have very many friends there, but if you ask what is the percentage on programming, and you get 5%, you are by far too high. And when they start PL1, what are they doing, they are not using their research, they are selecting three people out of some programming development unit in IBM and three representatives of the customers. They go at weekends on an island and they produce their PL1. Absolutely ridiculous. Whatever we managed to make *the Vienna definition language*, a tool which was really able to define practically the whole language. There are one or two corners where you could say, now, that is not finished, and I would say, yes. But in general we really managed a program. IBM was impressed, but did not think of making this next step, developing another language. You should see my letter communication with IBM. You know that PL1 was not PL1 from the very beginning. In the beginning it was called NPL, *New Programming Language*, and i got the letter: "How long do you think it will stay new?" I had no real answer, but they changed the name. The next name was *Multipurpose Programming Language*, MPPL, but that did not stay also very long, and then we got PL1. And I got a letter: "What about PL2?" And the answer was: "What do you think? This is not a time sequence, PL1 is *The Number One"*. So you see they did not have it easy with me, I had one guy in IBM who really protected me and helped me a lot and that was Bob Evans (Bob O. Evans, leader of the team that developed IBM 360, which is the first computer that enabled different applications to run on the same system simultaneously). He was a Corporate Vice-President and he was the Additional President of the *Systems, Development Initiative*. I looked in the following way. When we moved from the University to IBM we could probably have ended in the research, but knowing that the IBM research was nothing in the programming language, what I am doing there? I can tell you a number of funny stories. One day they closed, as you know

they somehow closed the Vienna laboratory and before that already removed me and changed the nature and I had to go up to the ramp and the speakers desk and the president of IBM declared me IBM Fellow and he said to me: "You are going to Zurich", What am I doing in Zurich where there is also no programming? So I visited my friends, I had of course, my IBM friends in Zurich. There are many such stories. 1 once returned with the boss of Zurich and I said what do you bring? I knew he had spent a four nights in America and I said you must have collected a number of ideas. But they finally got the Nobel Prize and that changed them. But Vienna was ruined.

Zemanek: Switching algebra is the formal definition language for the circuitry. So you got, the problem you have is that normally in switching algebra time is not involved. And that gets complicated. 1 have a publication on time-defined switching algebra, but this work never was continued. About the timing I worked very well, I understood of course that you have to look on it, because if you look on telephone switching, as I said already, you have analogue devices there. That is not fully featured.

Pichler: You have what we call in German audio-gramme this is how the different conducts of relay circuit would he overholmed.

Zemanek: This is exactly the work where I have been the first reader,) show you the book.

Pichler: You have here also manuals until today?

Zemanek: Becausc the use also, the negative side.

Pichler: See, mentioned already that in Innsbruck I studied mathematics, on the other hand I also already, say, experience as a telephone service technician and my first love was relay circuits and telephone switching and when in Innsbruck they taught a course on automata theory, I went there and I was extremely disappointed because, sure, the time was missing, the element of time.

Have you read Markov's theories?

Zemanek: Sure, he worked also on this problem.

Zemanek; I said I would be impressed to know what a computer is.

Once you wrote in your article in IEEE Annals of History about the future information processing or something, that you dislike that on every new system we have to learn good and bad things and how to deal with the system, which is really an important message for the future.

Zemanek: I can also explain you that. You cannot go in a company of the size of IBM and start a sharp career and after two years you are in the, in the main body. That is impossible. And there my sentence reads that in IBM, how is it called, management team, the physicists arrived when the programmers should already have been there. And that is a time when you cannot reproach to anyone, that is quite normal. Another weakness is the following: Mr. Watson Senior was The Man for the Hollerith machinery ". 2

T.J. Watson Junior served in the navy and he saw there the radar equipment and therefore knew that the future is the microsecond and said to his father "Do not

2 **Herman Hollerith**, the founder of a company that become IBM.

bother about punch cards, they are gone before you will", the future is Electronics and that gives the IBM 360. There again you see how weak the thinking of IBM in those matters was. What was the next family? IBM 370. Were from comes the number 360? From the full circle; they promised that everyone is served by anyone of the family of 360, and then have a 370 which is ten degrees more. It is ridiculous but nobody felt that even.

Did you continue cooperation with Russian people, Soviet scientists, after Gavrilov?

Zemanek: Until I was once one in Soviet Union when it was not any more Soviet Union. But then, ok, let me tell you the Soviet story.

Yes, please. Was it possible to communicate freely with them? Or they were always controlled? Or how it was?

Zemanek: Yes, it was possible. Finally even got appointed as a member of the Soviet Academy, so there I had no problems. I started with switching algebra. I was first time in 1960 as I said. In 1962 I was already there for a switching conference, at that moment I came from Finland over Petersburg to Moscow. I also came once to Novosibirsk. I visited Ershov 3 in Novosibirsk. But most interesting for me were the visits in Tashkent because one day I became interested in the origin of the word algorithm. Do you know where the word algorithm comes from?

3 Andrey Petrovych Ershov a Soviet computer scientist, known by a pioneering work in
systems programming and programming languages. There is A.P Ershov Institute of Informatics in Akademgorodok 25km from Novosibirsk,

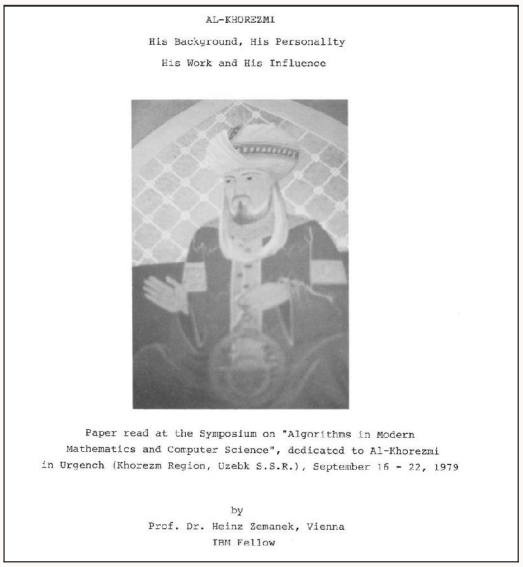
From this Arabic scientist Al-Khorezmi.

Zemanek: Yes. And where is Al-Khorezmi at home? Near the Aral See. And so **I** push Dorodnitsyn (A.A. Dorodnitsyn the director of the Computing Center of the Academy of Sciences of USSR, Moscow. There is Dorodnitsyn Computing Center, Russian Academy of Sciences, ul. Vavilova 40, Moscow, 119991 Russia) to produce a possibility to go there. You know, the problem is with the Soviet Union you had to plan the things ahead and you had to have all the permissions to go. If you did not have you cannot go anywhere. I once said to him, I want to go with this trans-Siberian train to Irkutsk and then go down via Mongolia to Beijing. Hopeless, you cannot do that. Or I had a student once and he managed at the second stay in Vienna, the doctorate of a guy from Odessa. I never could go to Odessa because the Academy has no institution in Odessa and therefore no way of allowing me to go there. But on the other hand I could convince Dorodnitsyn that I want to go to Tashkent and from Tashkent to Khiva, to Urgench. And we finally had then a bigger meeting in Urgench where I gave the main paper about algorithm 4,1 can give you one, and the Soviet people said this guy is not a cybernetician, he is a historian. One of their complements. I came back two times.

An excerpt from this paper is at page 35.

4 Heinz Zemanek: *DIXIT Algorizmi- His Background, his Personality, his Work, and his Influence,* in Andrei P. Ershov, Donald E. Knuth, (Eds.), *Algorithms in Modern Mathematics and Computer Science,* Proceedings, Urgench, Uzbek SSR, September 16-22, 1979. Lecture Notes in Computer Science, No. 122, Springer, 1981, ISBN 3-540-1! 157-3

The word "algebra" comes from a phrase (in bold below) in the title of an Arab book *"Kitab al muhtasarfi hisab al gabr w'at muqubalah.* This has been translated as "A compact



AL-KHOREZMI

His Background, His Personality

His Work and His Influence

Paper read at the Symposium on "Algorithms in Modern Mathematics and Computer Science", dedicated to Al-Khorezmi in Urgench (Khorezm Region, Uzebk S.S.R.), September 16 - 22, 1979

by

Prof. Dr. Heinz Zemanek, Vienna

IBM Fellow

introduction (book) to calculation using rules of completion and reduction," but Solomon Gandz has suggested **"al gabr"** comes from Babylonian **"gabru"** meaning solution of an equation, and that "muqubalah" (q reads like k) was its equivalent in Arabic. The book covered simple equations like the one in the preceding section, also quadratic ones involving x^2, as well as other areas such as geometry and the division of inheritances. Its author, **Mukhaminad ihn Musa** Al- **Khorezmi** (lived about 780-850) was the chief mathematician in the "House of Wisdom", an academy of sciences established in Baghdad by the Caliph A1 Ma'mun, son of Harun A1 Rashid of "Arabian Nights" fame. The "House of Wisdom" was involved in Al Ma'mun's expedition to measure the size of the Earth, which Al-Khorezmi afterwards estimated to have a circumference of 21000 Arab miles. (It is not sure how big the Arab mile was, the actual figure is about 25000 of our miles).

Al-Khorezmi's family (and possibly he as well) apparently came from the oasis of Khorazem, at the southern end of the Aral Sea, in what is now Uzbekistan. He is also credited with helping establish among the Arabs the Indian numbering system, using decimal notation and the zero. Previous systems of writing numbers used letters, like the Roman numeral systems or the cruder ones of the Greeks and Hebrews. When Al-Khorezmi's book on the new system reached Europe, the Europeans called its use "algorism" or "algorithm," a corruption of the author's name. Today "algorithm" means method of calculation, and the rise of computers has led to extensive work on developing efficient computer algorithms.

Did you possibly meet Shestakov? This is also very interesting. He was a pioneer in this area in Soviet Union.What is your impression about him? Like a person? Or did you know him well?

Zemanek: Sure. Yes. These people, I have, I think I was in Gavrliov's private apartment. In one of the guy's, I was in private apartment. But Shestakov I met only in his office room. You know we have in Vienna social apartment houses which were by the socialist party started after World War I.

Pichler: By the city government.

Zemanek: Ok, now similar things exist there and it was on the ground floor of such a building and there he was sitting and calmly working on these ideas and the desk was where nobody visited him because then he was not disturbed. That is my impression.

And about Gavrilov? Was he a leader of the group or? How the work was organized there?

Zemanek: Yes, he had a higher position. The main point in Moscow was the Mathematical Center and the boss of that was Dorodnitsyn and he was my main protector, he took me so to say over from Gavrilov. And then, he was my friend, he was in my summer house, I was not in his dacha but I spent, as you said.

You mentioned that in some period in the Soviet Union they did not like quite much mathematical logic as an area, it was considered like Western science.

Zemanek: Like cybernetics.

Yes, what happened later on with this? Who changed maybe some big politician?

Zemanek: On the very beginning they said Cybernetics is a bourgeois nonsense, and then obviously somewhere from GULAG 5 or so, the influence came that this is much more, much more general and suddenly overnight cybernetics was a, a column of the philosophical Soviet's teaching. And as a consequence, they started in Kiev an Institute for Cybernetics with 2000 people. More or less overnight. With Glushkov 6 as the force. So you had the Ukrainian Dorodnitsyn as the boss of the Computational Center in Moscow, and Glushkov, the Russian, as the boss of the Cybernetic Institute in Kiev. That belonged to those you know equilibrium attempts in the Soviet Union, And Ershov was a mathematician. There are two Ershovs 7, two mathematicians, but one never came out of Novosibirsk, And A.P. Ershov ended also in Novosibirsk, and when I said you poor guy you are banned to four hours away of Moscow, he said no, no I was born there, I like to go there. It was anyway a thinking error because if you are in Novosibirsk you are four-five hours away off the Moscow decisions. And Dorodnitsyn was a master of knowing the decisions. The Bulgarian boss once tried to kill Dorodnitsyn. Dorodnitsyn knew it before the decision really come to Moscow and could avoid it of course.

5 Glavnoye Upravlyeniye Ispiavityel'no-Trudovih Lagyeryey i koloniy, The Chief Administration of Corrective Labor Camps and Colonies, a division of NKVD Narodnyy Komissariat Vnutrennikh Del The People's Commissariat for Internal Affairs.

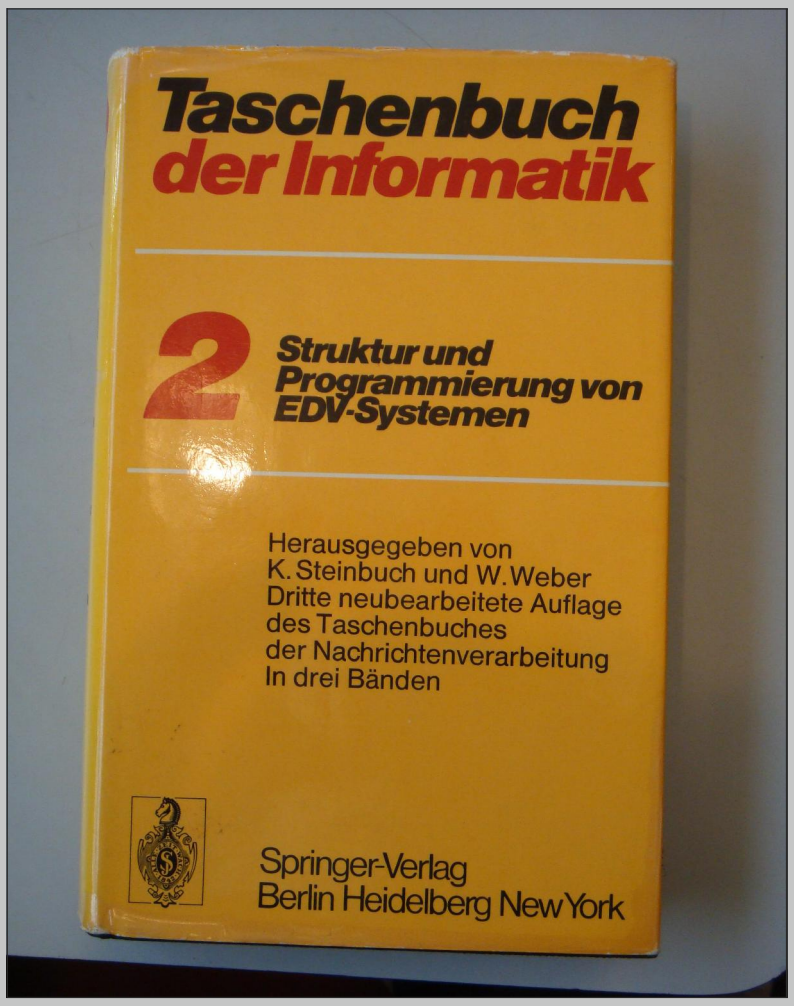
6 Viktor Mikhailovich Glushov, the founder of Cybernetics and information technology in USSSR.

7 Yuri L. Ershov is Editor in Chief of the Siberian Mathematics Journal and an editor of the Russian journal Algebra i Logika (Algebra and Logic), who was bo rn in Novosibirsk.

So these are the fine structures of the Soviet Union.
They had a certain confidence in me, which I had step by step built up. They knew on Zemanek you can trust. I give you one example. We are in Tashkent and I have a strict wish, I want to put my hand into the Amu Darya river. It was made possible and I did so. And along that river bank my wife discovered a heap of used Soviet car plates. I said they are nice, with letters X and Z(in Cyrillic which is H and Z in Latin), can I have one? Sure, and this immediately, not this one, look for a fine one, and the search for a while brought almost new plates and said no, no. no, we clean them and they were presented to me as a big gift. 24 hours later he knocks at the door 1 am sorry can you give us the plates back, they are still needed. In such a moment you must think very fast and you must be cooperative, I tried the gag of saying, "Yes here is one", but they say "No, no, no there were two, the second one". The point of the consideration was this: First of all, every car driver is under suspicion that he has a contract with the secret service. Secondly they have car drivers who speak German for instance, they are Volga Germans and so. When they discovered one day that I had a driver for this day who spoke German, he was immediately replaced. And here the point there was the following. If I come to the borderline, you cannot be sure, I never, in all my visits to the Soviet Union was investigated by the customs. The border police, that is something else, there they had no influence, but pass through the border line officer I was gone and the customs had nothing to say but they could not be sure of that, and if by some, imagine by some silly accident they find in my luggage these two plates. Then they look up where are they from and then they find out they do not exist anymore, they are already destroyed because these heaps were of course things as being totally unusable and destroyed. In reality they took care, in two thousand years they are gone. And so they said this we cannot list and really my friends would have suffered enormously if they would have turned out and so you leave them there and say no word. And such instances, we had more than one, and they knew in me one can trust.

A similar arrangement was necessary in America, because in my position as a Laboratory Director, theoretically I was not allowed to go to the Soviet Union, so they had to make IBM special permission which would have the consequence that certain parts of IBM, I was not allowed to visit. But since they did not recognize the importance of programming I was not permitted to see.


Heinz Zemanek



This book contains an extensive overview of the scientific work by Prof. Zemanek.

A series of post stamps issued by the Austrian Post (Österreichische Posts) dedicated to Prof. Heinz Zemanek.


HEINZ ZEMANEK
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COMPUTER GESELLSCHAFT
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Talks at the Museum room within the building of Austrian Computer Society (Oesterreichische Computer Gesellschaft)

Many students would visit this place.

Zemanek: They misunderstand museums as an enterprise for children. Totally wrong. You do not understand any technical object unless you know the story. And not only object, even when I entered IBM and I started the story of IBM, then you understand many things that you would not understand otherwise.

Yes, that is very important to learn.

Zemanek: It is possible that the census of 1890 with Hollerith machines in America was repeated in Austria with a delay of only six months nobody knows that.

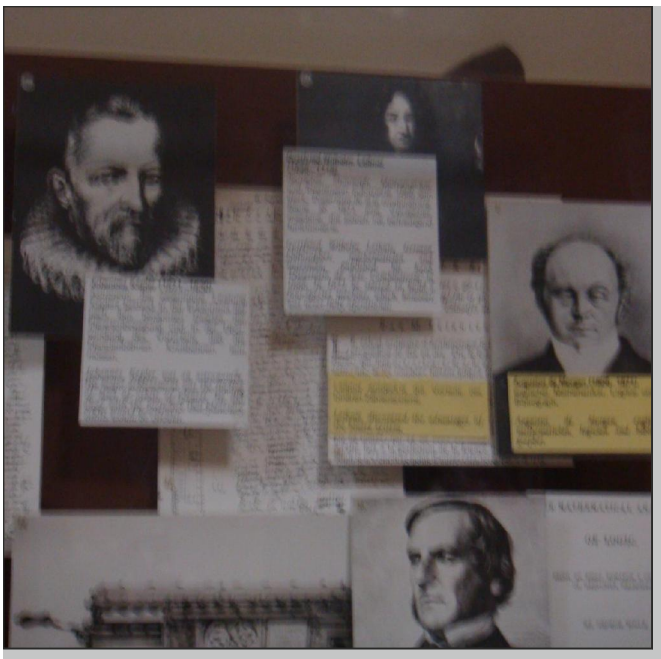
Pichler: *Professor Zemanek has made a detailed research of this work.*

Zemanek: I had to recover it. I would like to say if I make the money 1 leave the glory to the post people.

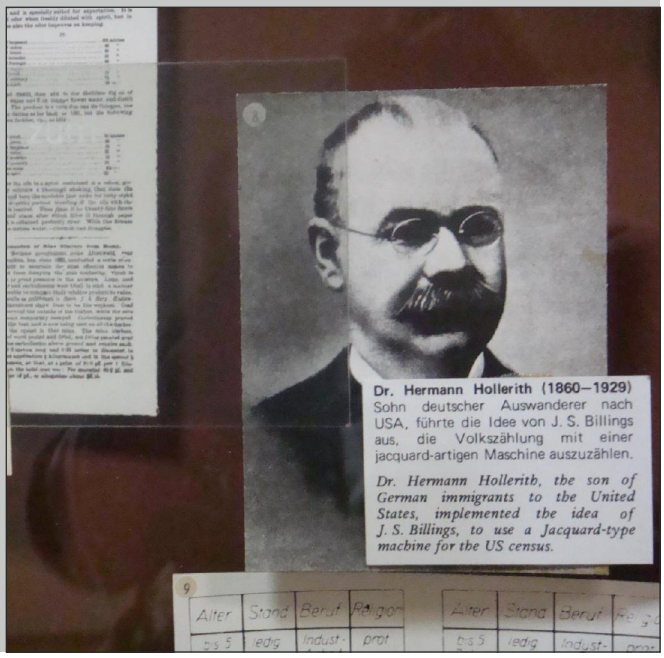
John von Neumann 8 *and Oskar Morgenstern* 9 *are also here.*

8 John von Neuman, a Hungarian origin American mathematician with very important contributions to many areas as computer science, economics, game theory, quantum mechanics, statistics, etc.

9 Oskar Morgenstern, a German-born Austrian economist, who formulated with John von Neumann the Neumann-Morgenstern expected utility theorem or hypothesis.




Mechanismus
Maschine.


Dr. Hermann Hollerith (1860–1929)
Sohn deutscher Auswanderer nach USA, führte die Idee von J. S. Billings aus, die Volkszählung mit einer jacquard-artigen Maschine auszuzählen.
Dr. Hermann Hollerith, the son of German immigrants to the United States, implemented the idea of J. S. Billings, to use a Jacquard-type machine for the US census.
Alter
Stand
Beruf
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Alter
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ledig

Zemanek: Gödel produced hardest hour in my life. You know, with Morgenstern we were friends more or else, and he organized a visit to Gödel, and the first question of Gödel was "Now, on what are you working?" And I answered very proudly "Programming languages". "They are absolutely unnecessary. Logic is sufficient". Then 1 took an hour to try to explain him why programming languages make sense. I do not think I convinced him but 1 think I impressed him.

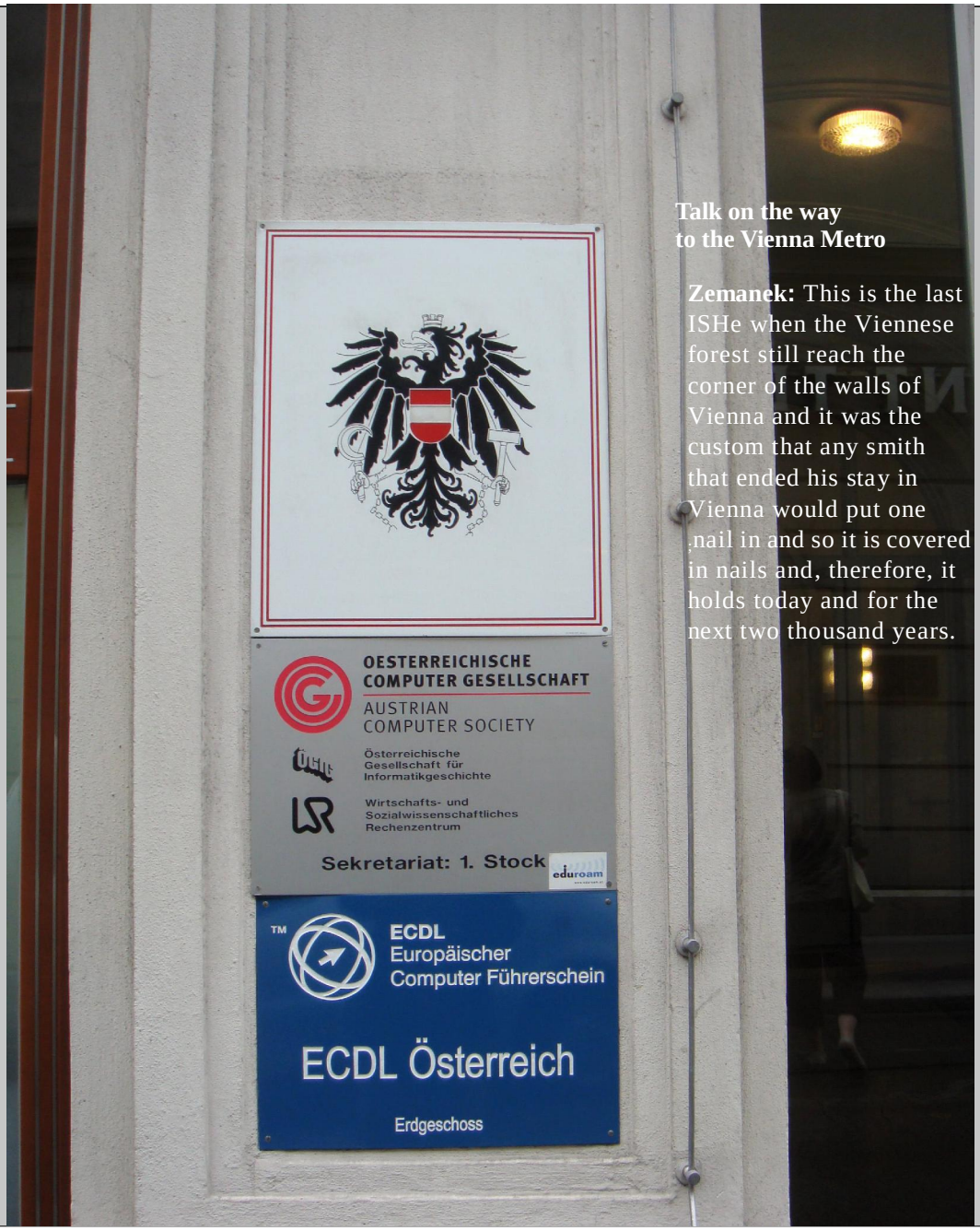
At the University I have a copy of Norbert Wienner's book and that was the beginning of cybernetics in Austria. It has a signature by my boss. There were, of course, a number of Jewish students who escaped to America and then they came to visit the University, and one of them brought this book and I got it from the boss then I tried to understand this book. I did not. I mean, the first 30 pages which give the motivation why he would deal such a subject, they are ok. But the following mathematics you can throw away.

Pichler; It is not complete, yes. You cannot follow.

Zemanek: No, you read this mathematics, it is interesting. I asked him when I was with him on a boat on the Moscow river, and I asked whether he had Viennese ancestors and the answer was "No".

But Shannon also had some disputes with some important people?

Zemanek: Shannon was not very communicative, I would say. He was difficult already before he fell in the real disease.



Talk on the way to the Vienna Metro

Zemanek: This is the last ISHe when the Viennese forest still reach the corner of the walls of Vienna and it was the custom that any smith that ended his stay in Vienna would put one ,nail in and so it is covered in nails and, therefore, it holds today and for the next two thousand years.

Pichler: Professor Zemanek is working on the sixth edition of a book about calendars.

Zemanek: I have been working on it for fifty years now and I want it to be published.

It is a very interesting and important subject. How you understand the concept of time, and similar subjects?

Zemanek: And I include of course the Islamic and the South American calendar.

That is very interesting, that Incas and Maya Indians have had calendars, and so very precise and sophisticated calendars. This is really fascinating. A civilization that disappeared just like that.

Zemanek: There are now so many broadcasts which destroys a number of fairytales about the Incas. At that time the discoverers were interested in peace so they described them as peaceful people. And also the fact that their culture disappeared has to do with that. There was nothings.

But this way of writing, the khipu, was actually a three-dimensional code.

Zemanek: There are many codes of recording the numbers. There you should know how long it was really used.
Do you know the Greek letter code? Very easy. You need 27 letters, (Nine letters are needed for the units, nine for the tens, and nine for the hundreds.) but you can use only 24 (Greek alphabet has 24 letters). The principle is that you have A for one, B for two, G for three and so on until nine. Next letter is 10, the next letter K is 20, lambda is 30, and so you come up to 90. Three disused letters were taken, one in

each group. 6 is digamma or stigma, 90 is koppa, and 900 is sampi. All mathematicians used this and that worked until the Indian numbers came via the Arabs.

You were born in Vienna and this is central part of Vienna.

Zemanek: And I live now also in a house not far and I go these two stops in the morning when I go to the office.

But Vienna is so beautiful town, so important.

Zemanek: First of all, in the Second World War we were damaged, but we were extremely lucky that because these arc historically important buildings. In all the cases they are historically important and so we had to rebuild. But in essence we have rebuilt the city more beautiful that it was. This old building here on the left hand side is Theresianum (Theresianische Akademie Wien) built by Maria Theresia eighteenth century (1746) and my son was going there.

A school with such a huge history this is something really very impressive.

Then, we were walking near Stephansdom.

Zemanek: You want to see my books?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Talk at the Technical University of Vienna

At the entrance of the Zemanek Hall

Zemanek: Many year ago this was a classroom to teach railway engineers. And then 1 saw this under repair and I liked immediately and then they devoted it to me.


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Gründungspräsident der OCG, 1975
IEEE Computer Pioneer, 1985
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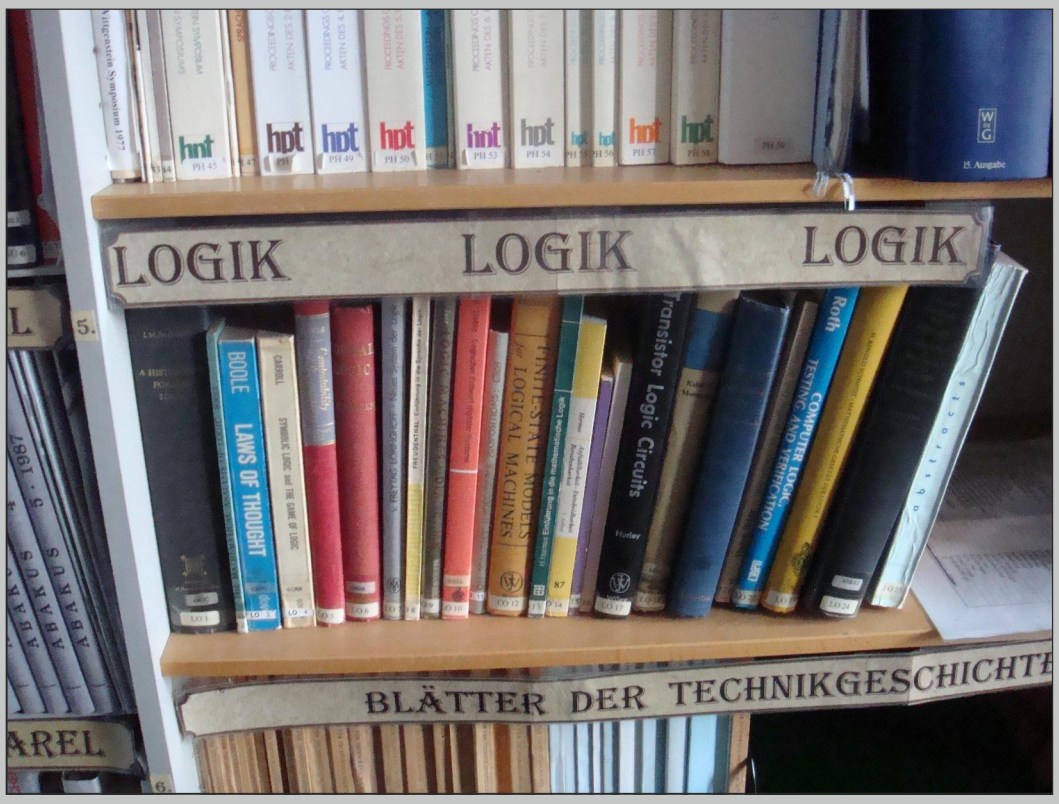
SEMINARRAUM



The office of Prof. Zemanek is a treasure of a wonderful collection of publications from the origins of computing until now.


SCHALTALGEBRA SCHALTALGEBRA
Basic Switching Circuit Theory
SCHALTALGEBRA 1938 62 IV
KATALOGE
OLDENBOURG
ELEKTRONISCHE RECHENANLAGEN
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In the office of Professor Zemanek

This is also very interesting, the Genetic Code by Isaac Asimov.

Remark for Collection of papers on Switching Theory

This is very unique book. A great, Nakashima paper, it is the very first paper in Switching Theory. This is whole collection of Nakashima work. Shestakov, Tsymbalisti, Povarov, Moisil.

Zemanek: This is Antonin Svoboda, my Czech friend. He came twice, once in the Nazi time, and the second time in the communists time. And he planned this very carefully, so that his family left Czechoslovakia in one and the same day but on the different points. At the other side the American helpers were expecting them.

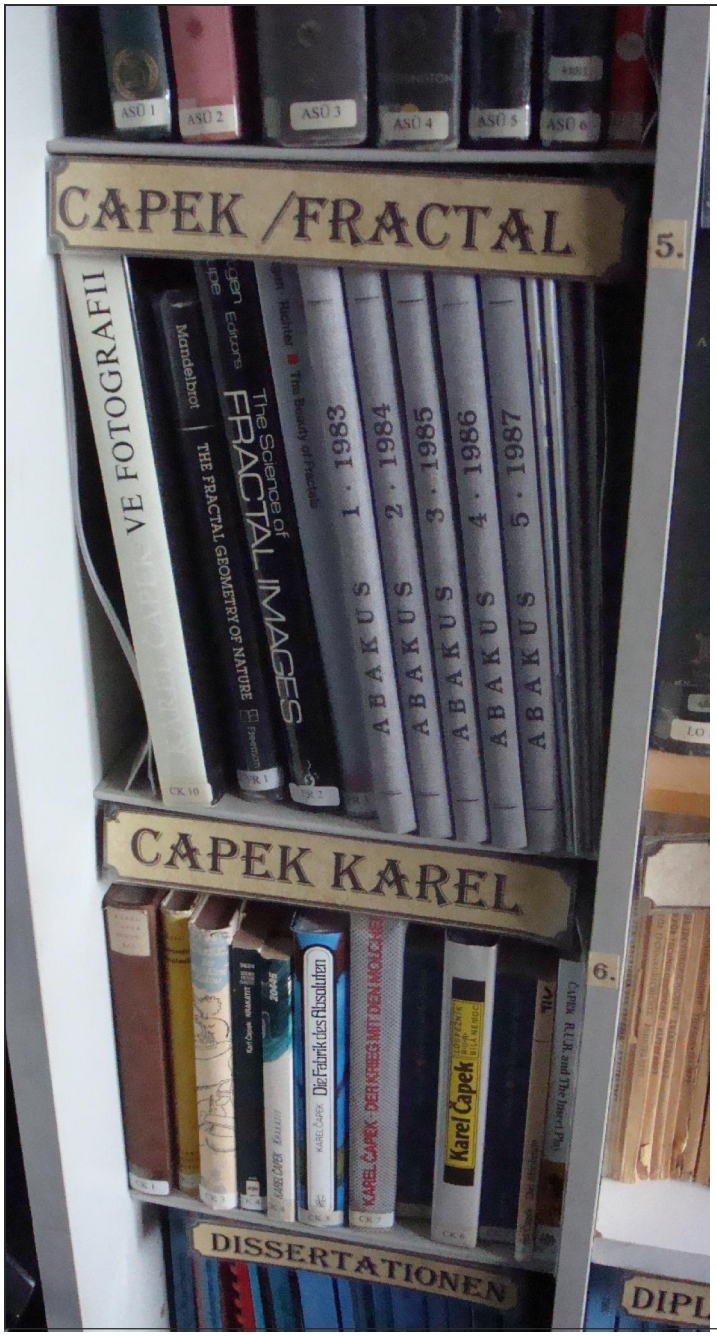
Here is the Aiken. The Californian workshop, San Dimas.

That was the step from intuitive switching algebra to mathematics systematic. Here is the full content. Hansi Piesch and again Piesch 1939. This is Mikhaluk paper that forgets to say that the brain is analogue. Then you have Duschek.

Are you familiar with the name of Karel Chapek? He created the notion of the robot. 11

10 **Karel Capek** - was one of the most influential Czech writers of the 20th century.

11 First used in a science fiction play *R. U.R. Rossum's Universal Robots.* The word *robot* comes from the word robota meaning work in Czech. Slovak and Polish. The origin of the word is the Old Church Slavic rabota used formerly and also presently in Serbian and Russian. This word comes from the Indo-European root orbh.



And here is a book about fractals and Benolt Mandelbrot 12 was my friend 1 made for him possible to use the Vienna picture out of my door. This is Adolf Adam 13, the gay who started the Linz University. He was an originator of this University.

*Here is about sampling, Karl Küupfmüller.*14

12 **Benolt B. Mandelbrot** is a French and American mathematician of Jewish origins born in Poland, word renovned as a founder of fractal geometry,

13 **Adolf Adam** - Austrian scientists known by contributions in informatics and statistics.

14 **Karl Küpfmüller** - a German electrical engineer, recognized by contributions in communications technology, measurement and control engineering, acoustics, communication theory and theoretical electro-technology.

Küpfmü ller can be considered as one of the founders of systems theory. His book *Die System Theorie der elektrischen Naehrichterttibertragun* in 1949 is a pioneering work.

Zemanek: John von Neumann, 18 he wrote two papers, he is important, basic thinker, but what he writes for instance about thinking is nonsense. Also, at the beginning he made absolutely clear that you cannot accept the definition he introduce. Is a wheal a fish or a mammal? Who knows that, if you take from the whole population, you can make a decision it is a mammal. So this is not a method to do that, but he makes exactly the same.

If you cannot distinguish to be award whether behind is a human being or not, what does it mean, you make the same kind of popular decisions. So prove.

18 **John von Neumann** - a Hungarian American mathematician who made major contributions to a vast range of fields, including set theory, functional analysis, quantum mechanics, ergodic theory, continuous geometry, economics and game theory, automata, computer science, numerical analysis, hydrodynamics (of explosions), and statistics, as well as many other mathematical fields.

Then you have Burks, Arthur and Alice. I lived once for a couple of days in their home. 15, 16

D. Leonardo Torres Quevedo, 17 this is the gay who built the first really working chess machine.

15 **Arthur Walter Burks** - an American mathematician who in the 1940s as a senior engineer on the project contributed to the design of the ENIAC, the first general- purpose electronic digital computer.

16 **Alice Rowe Burks** is an American author of children's books and books about the history of electronic computers

17 **D. Leonardo Torres Quevedo** – a Spanish engineer. In 1890 he introduced an electromagnetic device capable of playing a limited form of chess, king and rook versus king. The machine demonstrated that it is possible to make a device implementing a specified set of rules.

Also a good friend of mine was Joseph Weizenbaum 19, he wrote books on the power of human thinking.

Because he invented ELIZA. 20 he was misinterpreted because they said the machine Weizenbaum created is the machine psychiatrist. Then he wrote the books against it.

19 **Joseph Weizenbaum** - a German- American computer scientists of Jewish origin, widely known by a program performing natural leanguage processing. By using pattern of mathematical rules to human conversation, the program was capable to engage a **human** in conversation producing responsible replies.

20 ELIZA - A Computer Program for the Study of Natural Language Communication between Man and Machine," *Communications of the Association for Computing Machinery* 9 (1966): 36-45.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PHILOSOPHIE


PIONIERE
Karl
KÜPFMÜLLER
1897 - 1977
John von
NEUMANN
1902 - 1957
D.Leonardo
Torres
QUEVEDO
1852 - 1936


PIONIERE
PIONIER
BEKIĆ
Hans
1
2
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4
PROGRAMMING LANGUAGES
H. BEKIĆ


K. ZUSE
K. ZUSE
REPRINT SERIES FOR THE HISTORY OF COMPUTI

Do you possibly know why Johanna Piesch published under three names : Hanna, Johanna, and Hansi? Why she did not care? Was she Jewish?

Zemanek: No, no. The problem was that it is one name, when you are called in Vienna Johanna, nobody sees it and you are not normally addressed by Johanna, you are addressed by Hansi or Hanna. So that was only reason for this. I criticized her. 1 said you developed a name you should keep it constant. But for her that was not the point. You know she was a tolerated researcher in that area and she could do
what she liked. What more could she ask for?

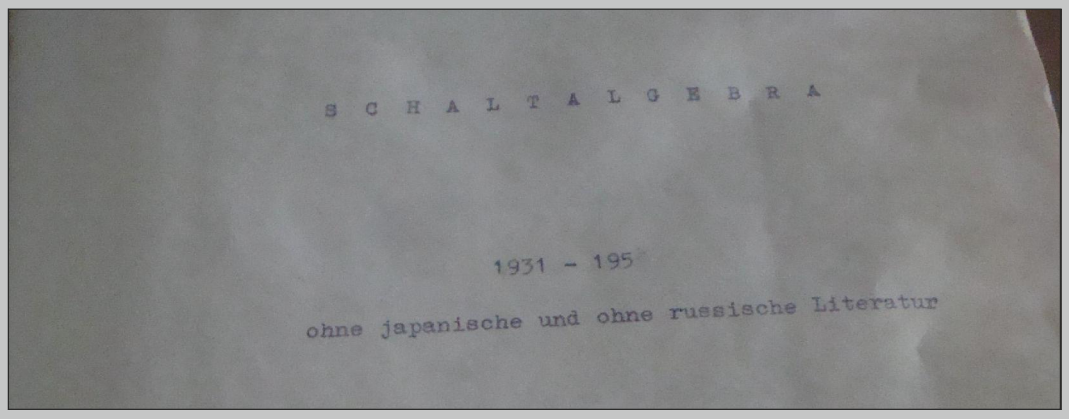
But in one period she moved from Vienna to Berlin ? Is it so, or?

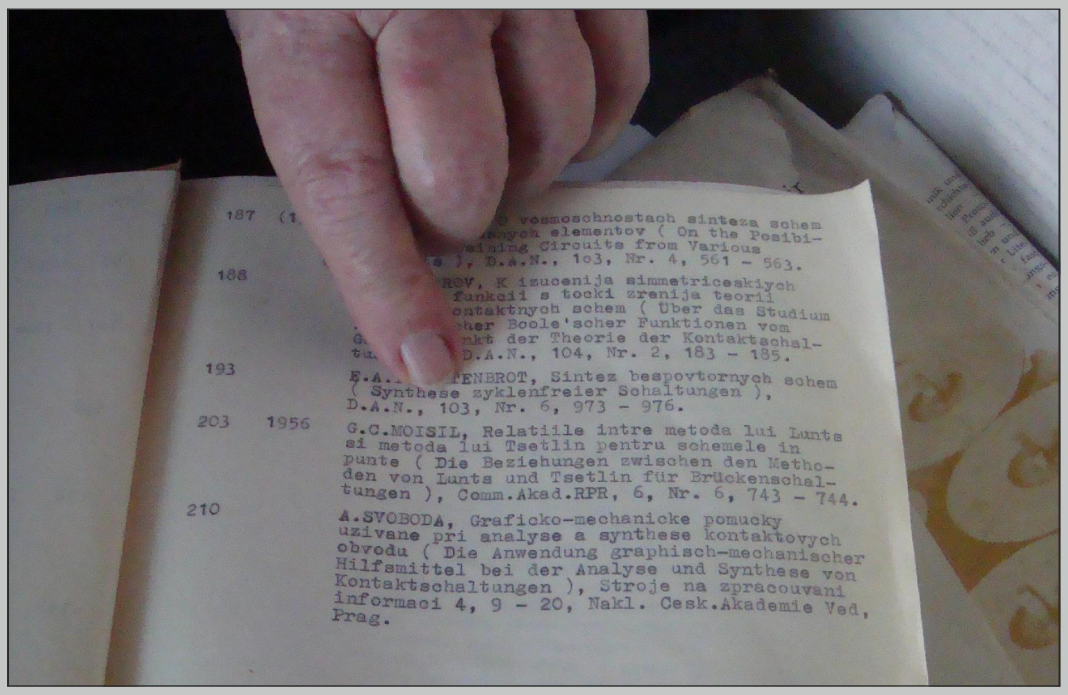
Pichler: She was for a while in Berlin, yes. Whether I have those data I am not sure. But she lived here in the neighborhood of the Southern Railway Station. She was an Editor of the AEU (Archiv elektr. Ubertragung) at that time in '67 or '66 and when I published my first paper in the AEU, I travelled from Innsbruck to meet her and give her my paper for publication.

Zemanek: Just now that you tell me that I remember, I had so many items in my life that it is difficult to keep.

Here is again Johanna Piesch. I was thinking that she is of Jewish origins.

Zemanek: No, no, in my knowledge, she was all the time in Austria, here in Vienna, except the time she spent in Berlin, and for a Jewish this is impossible.


S C H A L T A L G E B R A
1931 - 195
ohne japanische und ohne russische Literatur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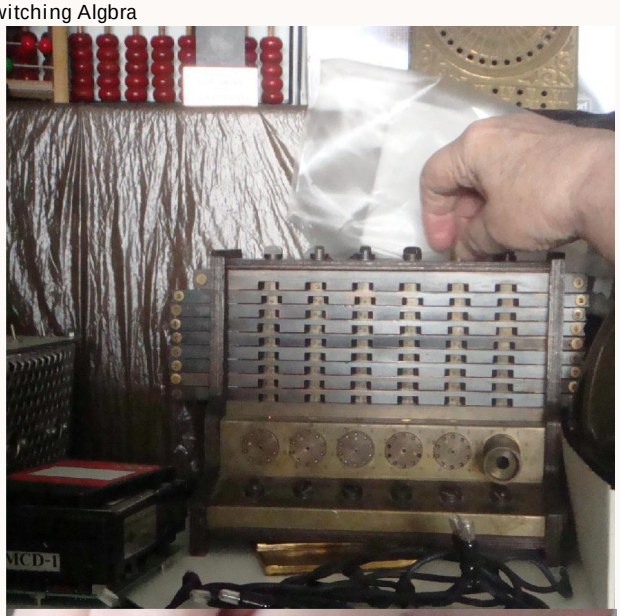
G.C.MOISIL, Relatiile intre metoda lui Lunts si metoda lui Tsetlin pentru schemele in punte (Die Beziehungen zwischen den Methoden von Lunts und Tsetlin für Brückenschaltungen), Comm.Akad.RPR, 6, Nr. 6, 743 - 744.
A.SVOBODA, Graficko-mechanicke pomucky uzivane pri analyse a synthese kontaktovych obvodu (Die Anwendung graphisch-mechanischer Hilfsmittel bei der Analyse und Synthese von Kontaktschaltungen), Stroje na zpracouvani informaci 4, 9 - 20, Nakl. Cesk.Akademie Ved, Prag.



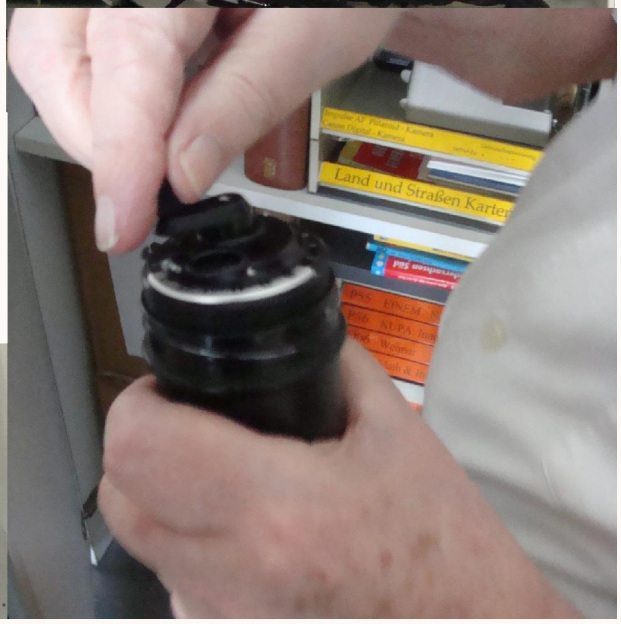
all the book back, but this is normal, quite normal. Here, we can see all kind of souvenirs or parts. This was from an IFIP Stockholm Congress, which was my Congress, we had such a hat for everyone.

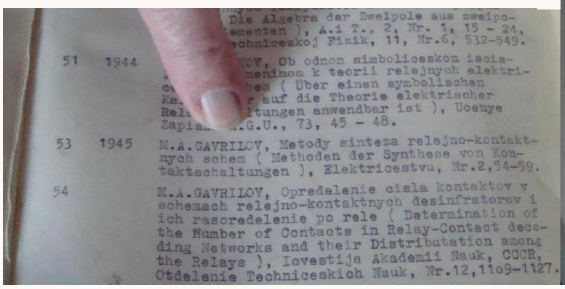
You know the Curta? This is a micro computing machine.

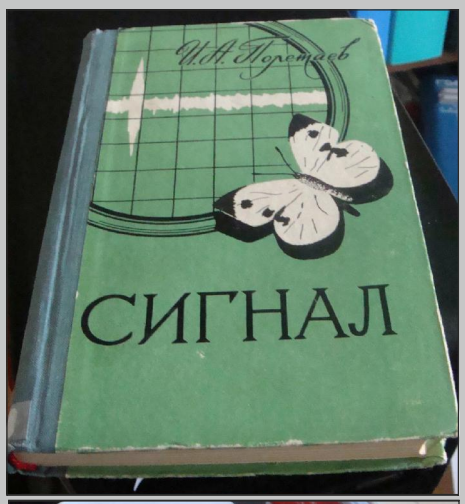
All kinds of abacus. You know the differences between the Japanese, and Chinese abacus, a lot of stories.

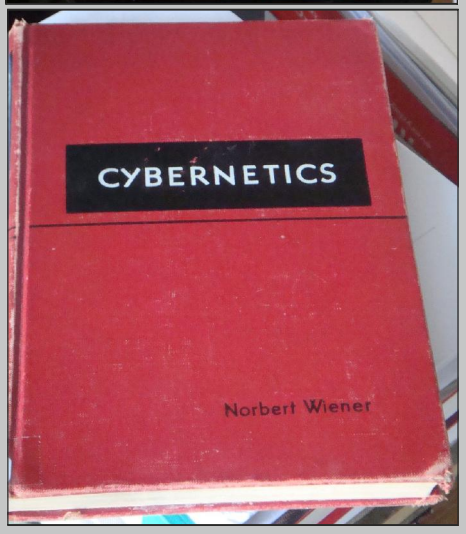
This is the forerunner of Pascal. It has these cylinders which you can turn. Can you see all the multiples of the number that you selected? Then you have to add them by means of this device here and you can really make the multiplication.

This is Siemens chip production from the early time.









Zemanek: Here is a collection of papers for Schaltalgebra without Russian and Japanese works. They are in separate volumes.

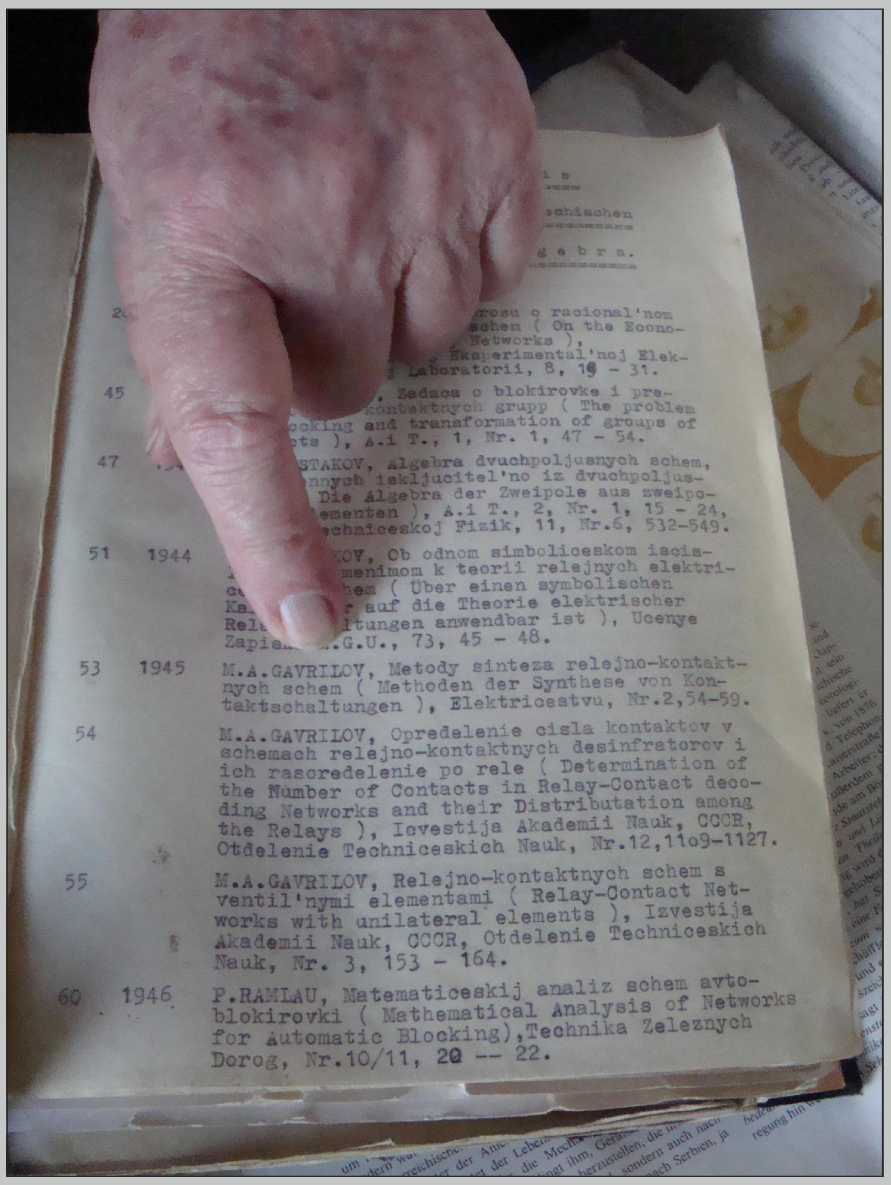
You know, in the time when cybernetics was not accepted in Soviet Union, one of the gays published a book, and of course it was absolutely hopeless for him to call it Cybernetics. Thus, the title of the book is Signal. This is the first book in Soviet Union about Cybernetics, and he was not permitted to call it Cybernetics, actually not permitted, since if he would call it this way the book will not be published.

This is a book on how in Soviet Union the cybernetics turn on the honest.

You said Robert Edler was the first working and teaching in switching in Austria?

Zemanek: Yes, yes, I followed lectures by him at the University of Technology in Vienna.

What else you will like to see in my other room. Elisabeth will have to put



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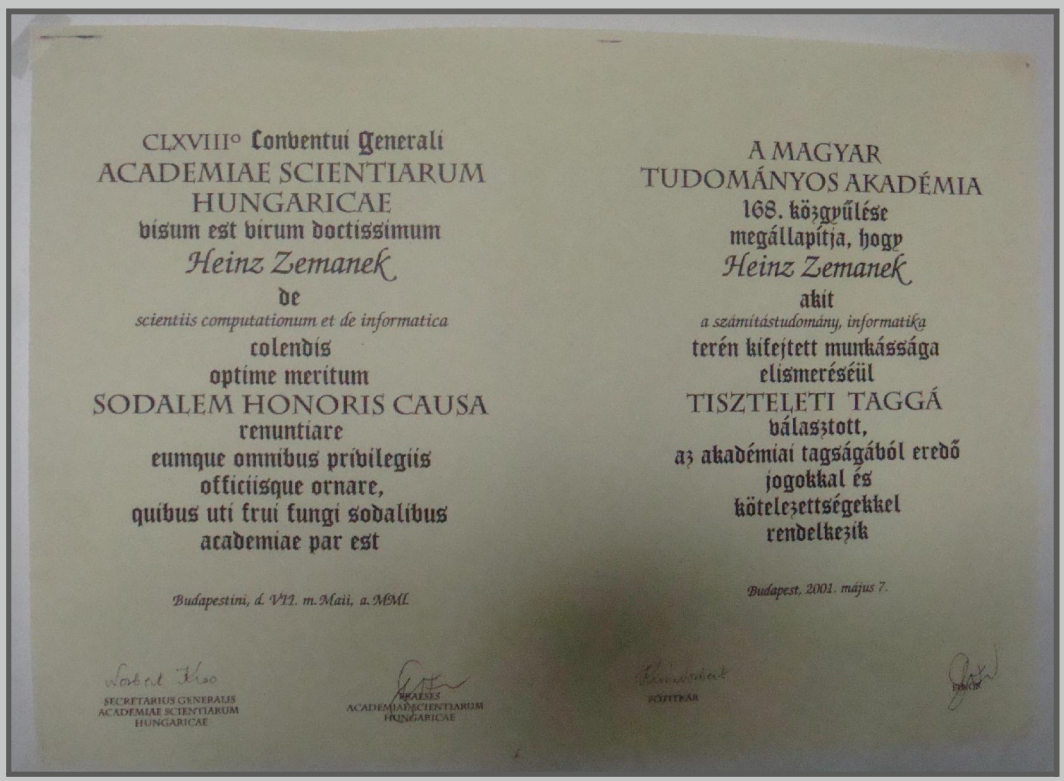
53 1945 M.A.GAVRILOV, Metody sinteza relejno-kontaktnych schem (Methoden der Synthese von Kontaktschaltungen), Elektricestvu, Nr.2,54-59.

54 M.A.GAVRILOV, Opredelenie cisla kontaktov v schemach relejno-kontaktnych desinfratorov i ich rasoredelenie po rele (Determination of the Number of Contacts in Relay-Contact decoding Networks and their Distributation among the Relays), Izvestija Akademii Nauk, CCCR, Otdelenie Technicheskich Nauk, Nr.12,1109-1127.

55 M.A.GAVRILOV, Relejno-kontaktnych schem s ventil'nymi elementami (Relay-Contact Networks with unilateral elements), Izvestija Akademii Nauk, CCCR, Otdelenie Technicheskich Nauk, Nr. 3, 153 - 164.

60 1946 P.RAMLAU, Matematiceskij analiz schem avtoblokirovki (Mathematical Analysis of Networks for Automatic Blocking),Technika Zeleznych Dorog, Nr.10/11, 20 -- 22.



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HUNGARICAE
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Heinz Zemanek
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colendis
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A MAGYAR
TUDOMÁNYOS AKADÉMIA
168. közgyűlése
megállapítja, hogy
Heinz Zemanek
akit
a számítástudomány, informatika
terén kifejtett munkássága
elismeréséül
TISZTELETI TAGGÁ
választott,
az akadémiai tagságából eredő
jogokkal és
kötelezettségekkel
rendelkezik

Budapest, 2001. május 7.

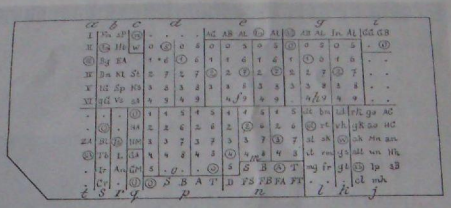
FŐTITKÁR

ELNÖK

M

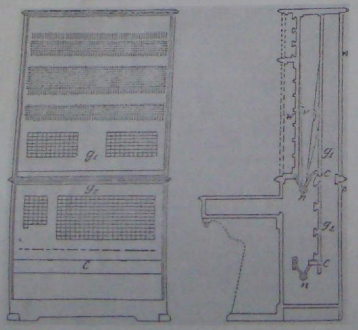
In 1955, Prof. Zemanek built the Mailüfterl, a first fully sistorized computer in tinental Europe, It was lized as a project with a group of students, unauthorized by the University, meaning also unsupported financially. Since the project confirmed reliability of transistors, in which Prof. Zemanek was convinced, Philips chapter in Eindhoven provided 3000 transistors and 5000 diodes. The rest of material was granted by over thirtyve companies, thanks to the organizational efforts of Prof. Zemanek

Lochkarte der österreichischen Volkszählung 1890.



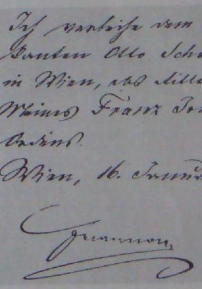
geräten zu. Er führt die Hollerith-Maschinen in Österreich ein, wartet sie und baut sie nach den Wünschen der Behörden um. Um die Volkszählung auf dieses moderne Verfahren umzustellen, bedarf es einer Durchführbarkeitsstudie; Versuchsmodelle müssen gebaut werden und die Stromversorgung — damals noch weit problematischer als heute — muß gesichert werden. All dies organisiert *Schäffler*, und ohne Kosten für das Statistische Zentralamt. Er ermöglicht Probeläufe für die Viehzählung und für die Armen- und Spitalsstatistik, so daß die Auswertung der österreichischen Volkszählung von 1890 auf solider Basis gewagt werden darf und zu einem vollen Erfolg für das Amt und für *Schäffler* wird. Es besteht die Vermutung, daß die russische Volkszählung 1895 auf Schäfflers Maschinen ausgewertet wurde, und um 1895 hat es — dank *Schäffler* — in Wien mehr Lochkartengeräte gegeben als im übrigen Europa zusammengenommen.

Aus diesem gleichen Jahr 1895 stammt ein Patent Schäfflers über „Neuerungen an statistischen Zählmaschinen", dessen Kopie uns das österreichische Patentamt liebenswürdigerweise übermittelt hat. Das Patent betrifft im Grunde eine Programmierungsmaschine, aus der man die Erfahrungen Schäfflers mit Klappenschrankvermittlungen erkennen kann: *Schäffler* ersetzt die bisher übliche Programmierung und Zusammenschaltung von Lochkartengeräten mit Hilfe fester Verdrahtung durch einen Vermittlungsschrank, auf welchem der Programmierer mit Hilfe von Vermittlungsschnüren die einzelnen Abläufe für jeden Kartendurchgang befehlen kann, ohne die Verdrahtung zu ändern. *Schäffler* nennt das Programmiergerät „Generalumschalter".



Der „Generalumschalter" (das Programmiergerät) aus *Schäfflers* Patent 463 182 vom 20. September 1895 (Priorität vom 30. Mai 1895).

Die Liste aller Patente Schäfflers umfaßt über ein Dutzend Patente, bei denen er Alleininhaber ist, und nicht viel weniger gemeinsame und übertragene Patente. Vor den Lochkartenpatenten kommen solche auf seinen anderen Arbeitsgebieten: Eisenbahnsignalwesen, Telegraph, Telephon und Mikrophon. Die Zahl der Ehrungen Schäfflers ist im Jahre 1897, als ihm der Kaiser das Ritterkreuz des Franz-Joseph-Ordens verleiht, schon beachtlich. *Schäffler* hatte 1897 das Goldene Verdienstkreuz erhalten, 1884 eine Anerkennung anläßlich der Internationalen Elektrotechnischen Ausstellung 1883 in Wien, und er war Officier de l'Academie, ausgezeichnet mit dem Ritterkreuz der Französischen Ehrenlegion.

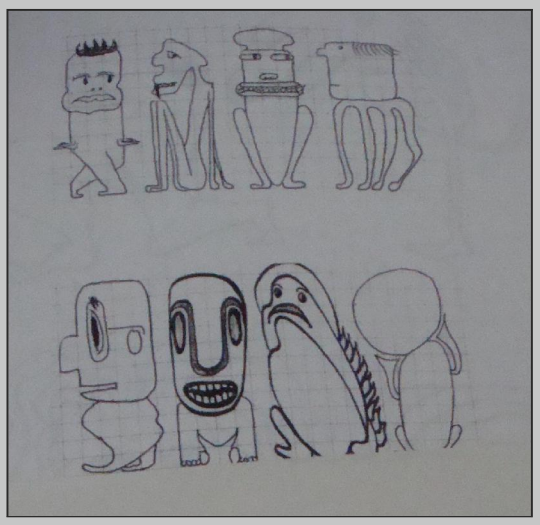


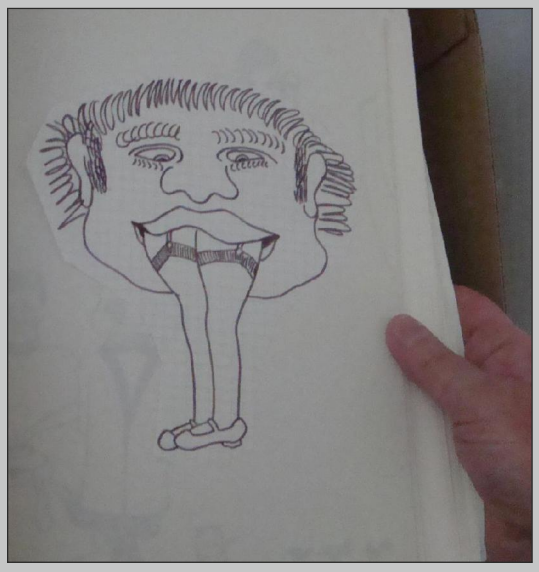
Kaiser *Franz Joseph I.* verleiht handschriftlich den Orden (oberstes Blatt des Aktes).

Otto Schäffler starb am 31. Juli 1928 in Wien. Bis vor wenigen Jahren war sein Name völlig vergessen und keine Hochschule schilderte das Werk dieses Pioniers. Seine letzten Lochkarten-Maschinen sind 1945 abmontiert und fortgebracht worden. Wir hoffen, eine ausführlichere Lebensgeschichte zusammentragen zu können — vielleicht kann man noch nachträglich ein wenig Ruhm aufbauen für ihn. Er selbst hat offenbar nicht viel dafür getan. Aber sein Werk spricht für ihn.

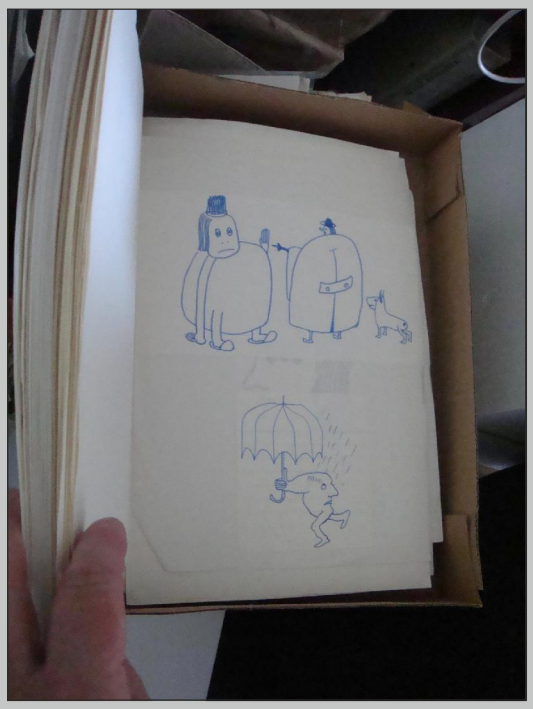
H. Zemanek

Zemanek: In a period of time, I made a lot of drawings. Unicorn is that selection. You know, I was for three years the President of IFIP 21 and one year a Vice-President. Then, you have to sit on the meetings, and not obligations, so I made this kind of drawings. But my poems 1 made in the War time when I was in Berlin.





21 *International Federation for Information Processing,* federation of national societies working in the field of information technology with offices in Austria.



Zemanek: Here I have another thing. Certain Mr. Schlesinger. You know what is the submarine? At that time the term submarine was used for Jewish people who hide during the Nazi time, for instance in Holland. Then a Viennese dancer, a great name Nagentle, she gave me a manuscript of this gay, and this is an interpretation of the last book of the Bible, by St. John, yes, Revelation, the Book of Revelation, or the Apocalypse, the secrete, and he interpreted this book of the Bible as the vision of the future. So, he brings a time scaling etc. 1 am not convinced of this, but it is very interesting.

Since you worked on very important subject during the War, how you succeeded to survive without much trouble?

Zemanek: That is a gentle story. Not very difficult. I tell you the beginning. **I** came one day at the University, the main building, and there arc the guards, the Nazi in uniforms, and so, and then I said to myself, they are not to stop your development. And I walked into the main office and 1 said "Comrades, I am not a Nazi, but I give you an opportunity to make me one". They attached me to one of the units, my problems were gone. Then I come to the Army and politics was not a problem. I managed to survive.

I was a friend with the Austrian composer Gottfried von Einem, 21 and I read in the Berlin Academy of Beaux Arts, where I am a member, a necrologium to him.

21 **Gottfried von Einem** – Austrian composer whose operas and orchestral works combine late-19th-century Romanticism with 20th-century compositional practices such as dissonance and atonality as well as elements of jazz. As the son an Austrian military attaché, he was educated in Germany and England. By using these strings, he helped several people to escape from Nazi Germany, and in 1939 was arrested by Gestapo for four months. The opera *Der Prozess* (The Trial), which he composed and first performed in 1953 was inspired by his arrest and by the novel of Franz Kafka.

Dr. Peter Goldscheider

Geboren 1945: nach Absolvierung des Akademischen Gymnasiums in Wien Jus - studium an der Universitat Wien. Wurde 1968 zum Doktor iuris promoviert. Seit 1968 Angestelller der IBM Osterreich.
Liebhabereien: Rechtsphilosophie, Dalenverarbeiiung und Recht, Sport.

Professor Dr. Heinz Zemanek

Geboren 1920; bis 1944 Studium der Nachrichtentechnik an der Technischen Hochsehule in Wien. Wurde 1950 zum Doktor der Technischen Wissenschaften promoviert: 1964 ao. Professor der Technischen Hochschule Wien. Leitete 1955 bis 1959 die Entwicklung des Rechenautomaten ..Mailiifterl" und befafite sich anschlicBend mil Programmierungssprachen sowie seit 1952 mil der Konstruktion von Geraien fur kiinstliche Sprache und 1952 bis 1962 mit der Kybemelik und mit kyhernelischen Automaien. Seit 1969 IEEE-Fellow. Seil 1961 Direktordcs IBM Laboratoriums Wien.
Liebhabereien: Geschichie der Automaien, Kunst mit Hilfe von Automatcn, Philosophie der Informationsverarbeitung,

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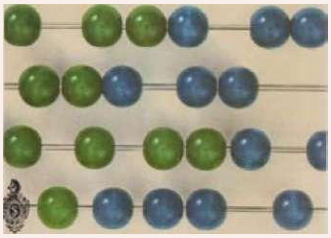
Das Buch zur Fernsehfolge „Computer'

Dieses Buch soil dem Belrachler der 10 Fcrnsehfolgen die Fluchtigkeit des ablaufenden Bildes in haltbarem Text einfangen, Ersatz leisten fur versaumte Sendungen und in vielen Punkten genauere Auskunft und ausfiihrlichcre Information goben.

Goldscheider - Zemanek

Computer

Werkzeug der Information



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These are my congresses. Such a book in German, this is yours.

I produced one day 10 TV movies on computers. It may be of interest for you.

Zemanek: This is an interesting machine, it stays in Brussels, and the story is this. At home I have a collection of some 35 metronomes. And then I really studied the origins and the history of the metronome. The gay who did that was Malzel (Johann Ncpomuk Malzel), but he stole the invention from the German mechanic who also worked in Amsterdam by the name of Winkel (Dietrich Nikolaus Winkel). He tried to protest, he was the smarter and strong one, but no hope, and then he thought I will in revenge play him negative point, and he constructed the composing machine which goes beyond everything nearly reproductive. The idea of the whole thing is the following. I have a novel play organ as you know that, but in this case there are two cylinders and two bars around one cylinder, next two on the second, next two on the first, next two on the second. And so throughout the whole composition and the composition is a variation on a composition, eight variations on a composition. Then, the machine docs the following. It starts with the first volume and there is a stochastic generator which says *Yes*or *No.* Depending on the results it moves from one variation to the next. And so it finds a stochastic path through all the variations back and forth, and some five million of possibilities to play then. Now, if you hear the first five, then you have a problem there. But anyway the idea is great. It stands in Brussels.

It is very impressive what kind of ideas people may have.

Zemanek: Yes, what ideas one can have, we must also consider the year in which it comes out.

Here is babushka.

Zemanek: Yes, and the Swiss writing machine.

Thank you very much for the wonderful lecture from history of Computing.

After showing us a shortcut
from his office to the centrum of
Vienna,Prof. Zemanek
returned to the University to continue
his work.


TICSP
Tampere International Center for Signal Processing