What is a Mathematical Machine?
Brief history of early computing in Poland

On December 23, 1948, the weather in Warsaw was particularly bad. Wet snow continued to fall as the inhabitants of the ruined city desperately tried to salvage what they could of their holidays with a meager meal for their family.

Only a small group of people seemed untroubled by the worries of the upcoming celebrations. These were attendees of a seminar on electronic calculating machines, listening to a talk given by prof. Kazimierz Kuratowski.

Kazimierz Kuratowski

Kuratowski was a renowned topologist and director of the Institute of Mathematics in the Polish Academy of Sciences. He had just returned from a lecture in the United States, where he was shown ENIAC, the first electronic general-purpose computer, dubbed in the press as "the giant brain". His excitement about the newly built machine gave the listeners great motivation to pursue a similar project and led to the immediate formation of a research team.

Thus, the new research team, later officially named the Mathematical Apparatuses Group, began building their own computer, despite having access to very limited resources. The researchers, who were barely surviving on the food parcels from post-WWII international relief agencies and wore leaky boots, did not have access to the proper equipment, parts, or even premises to pursue their endeavors. To make matters worse, members of the staff were often deported to the Soviet Union by the Russian forces, who had been occupying Poland since the end of the war.

Moreover, the new American advancements in relevant fields were not often shared with the public, much less other countries, due to their applications in the military. Even those that were released did not often reach Poland, as a result of the Iron Curtain.
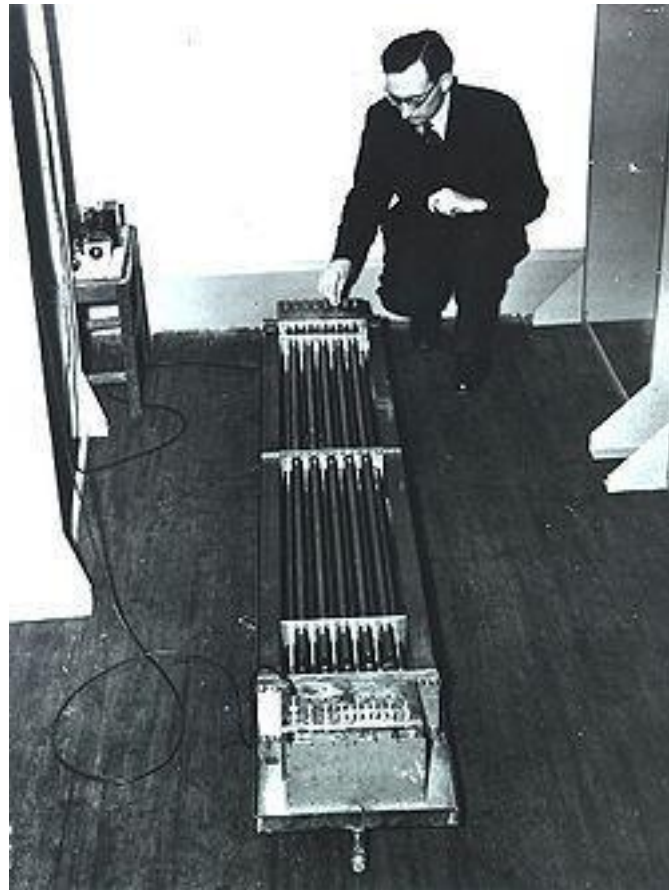
Analog or digital?

The Mathematical Apparatuses Group was provided three rooms at the Institute and for quite a while their work remained only on paper. Their first attempts to deal with real devices did not bring the significant results. For each damaged module they repaired, another one was breaking down, and the process would repeat itself.

Finally in 1953 they were able to get something working: an analog machine built with 400 vacuum tubes, which was called the Differential Equations Analyzer. It was able to solve complex differential equations with very high accuracy and was used for a number of practical applications, including the design of turbines and aircraft.

Differential Equations Analyzer

The next project was completed in 1955. The Electronic Machine for Automatic Calculations was able to perform 2000 additions or subtractions, 450 multiplications and 230 divisions per second, using an analog technology that operated on 1000 vacuum tubes. The solution which allowed for the "fast" memory of this machine relied on a number of glass tubes filled with mercury, which often times were not sealed properly, resulting in a health hazard.
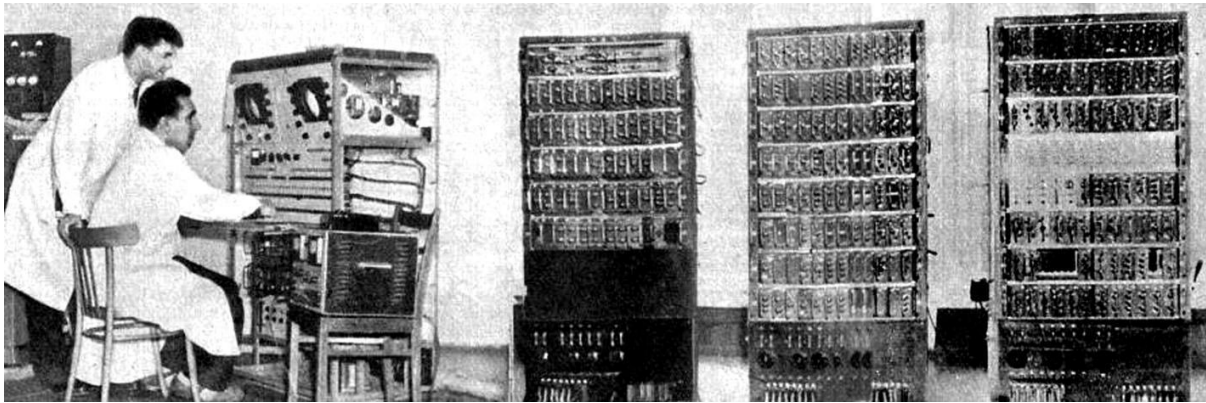
Mercury memory of the Electronic Machine for Automatic Calculations

According to an anecdote passed from one generation of computer scientists to the next, one of the team members remembered having seen cheap rubber bags sold at the pharmacy with the perfect dimensions for sealing the glass tubes. Apparently, the saleswomen at the pharmacy were not particularly surprised when he requested one hundred pieces, **but their admiration caused a request of an invoice for the Academy of Sciences.**

From ABC to XYZ

In order to consolidate the existing research and design efforts, the Polish Academy of Sciences established the independent Mathematical Apparatuses Division (Zakład Aparatów Matematycznych – ZAM) in 1957. It was there that, in autumn of 1958, the first Polish electronic digital machine was launched with the name **XYZ**.

It used 400 tubes and 2000 diodes, flip-flops on one triode, had drum memory and punched cards for input and output. It could perform up to 1000 arithmetic operations per second and had an internal binary language with symbolic addressing. The head of the team, prof. Leon Łukaszewicz, when asked by journalists why the machine was named XYZ, would answer: "Well, the version we started with was called ABC".

XYZ digital computer

At that time, commercial applications for such an efficient machine had just begun to emerge. In 1960 the first unit of ZAM-2 was built. It was improved XYZ with 600 kb of memory, teletype and paper tape reader and was suitable for mass production**.**

ZAM-2

The Mathematical Apparatuses Division, which by 1962 was operating out of its own building, began its transformation into the **Institute of Mathematical Machines** (Instytut Maszyn Matematycznych – IMM). In order to maintain the tradition, the Institute exists to this day under the old name, despite the burden of facing continuous inquiries (especially from younger generations) about what mathematical machines really are. The word "computer" was only allowed to appear in the Polish language fairly late -- in mid 70s. Before, it was routinely
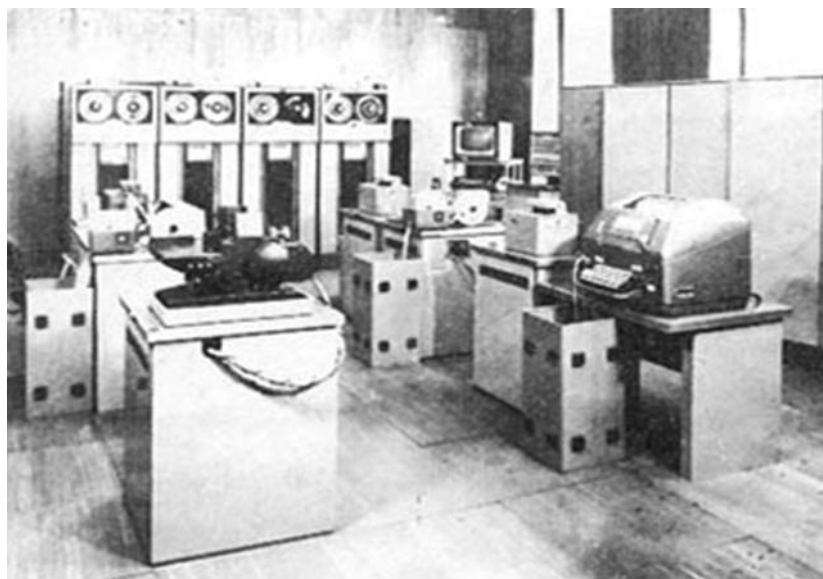
replaced by the censors' office with the phrase "electronic calculating machine", a compulsory copy from the Russian term for computers.

Instytut Maszyn Matematycznych

The end of pioneering

The new Institute continued ZAM's series with ZAM-3 and ZAM-21, launching in 1965. The last of them, ZAM-41, was not far from the contemporary notion of a computer - it performed 30,000 fixed-point operations per second, was equipped with a tape memory, line printer and other peripherals.

ZAM-41

IMM later became responsible for building mainframes R-30 and R-32, the Polish contribution to the "Unified System of Electronic Computers" released in the Comecon countries. With the advent of minicomputers, IMM became a strong center for designing and manufacturing Momik 8b, Mera, K-202, and Mazovia, as well as various peripheral devices. In the late 60s, however, numerous other research centers became involved in designing, producing and using computers for different applications ultimately ending the pioneering era of Polish research in computing.

Mera-400

K-202