Column

Parametron and Relay Computers Exhibition Held at Tokyo University of Science in November, 2018

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Ridai (Tokyo University of Science) Museum of Modern Science[2] held the exhibit "Parametron and Relay Computers Developed in Japan" from September 30 to December 1, 2018.[1] The museum was certified as a satellite museum of the Information Processing Society in 2008.[2]

Parametron Computers: Parametron[3] is a logic circuit element invented by Eiichi Goto[4] in the Laboratory of Hidetosi Takahasi[5] at the University of Tokyo in 1954 (see Figure 1). It consists only of nonlinear coils, a capacitor, and a resistor and uses the parameter excitation phenomenon. Major important documents about parametron preserved at the Parametron Archives[6] at the University of Tokyo were lent to Ridai Museum and exhibited.

Both original parametron elements and newly built parametron cards and boards were exhibited (see Figure 2). The newly built ones were prepared for the exhibit by Hiromichi Hashizume of the National Institute of Informatics (NII), Japan. He made parametron elements by himself using currently available parts. The adder operation based on majority logic was demonstrated.

Several events were arranged during the exhibition. Eiiti Wada, an Emeritus Professor of the University of Tokyo,[8] gave a talk on parametron starting from the principle of its operation using the movement of a pendulum to the parametron logic circuits based on majority logic. Finally, he demonstrated the operation of PC-1 Parametron Computer by using its software simulator on his note PC. The paper tape input operation, the contents of CPU registers during arithmetic operations, and printout of output on a printer were projected on a screen. It was an impressive demonstration. PC-1 was developed by Hidetosi Takahasi, Eiichi Goto, Eiiti Wada et al. at the University of Tokyo in 1958.[7,9]

The first parametron computer is MUSASINO-1 developed by NTT Electrical Communication

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Figure 1. Photograph of Eiitchi Goto and Hidetosi Takahasi and the figure of the principle of parametron operation using the pendulum principle. (Courtesy of Ridai Museum.)

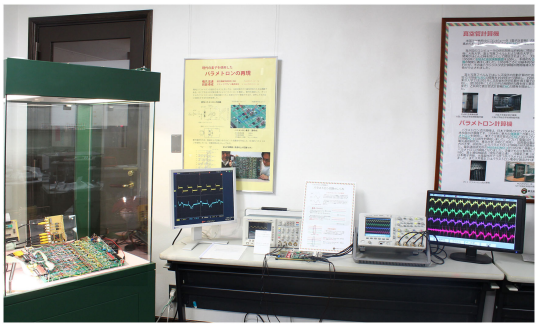

Figure 2. Parametron board (left) and cards (right), and the three-phase parametron waveforms. (Courtesy of Ridai Museum.)

Figure 3. Relay-based adder demonstration sets. (Courtesy of Ridai Museum.)

Figure 4. Explanation of relay-based adder operations. (Courtesy of Ridai Museum.)

Laboratory in Musashino, Tokyo, in 1957, which has the same architecture as ILLIAC I to enable to use the ILLIAC library. MUSASINO-1B, a practical model of MUSASINO-1, was manufactured in 1960 and used at NTT. It was commercialized by Fujitsu as FACOM-201. Ridai Museum displays this machine on permanent exhibit. Many Japanese computer manufacturers, such as NEC, Hitachi, and Fujitsu, developed commercial parametron computers in early times.

Eiichi Goto also invented the Quantum Flux Parametron in 1986, which is now used as a component of a quantum computer. (See the article "2018 NEC C&C Prize.")

Relay Computers: Relay components and relay-based logic circuit cards were exhibited and relay-based adder operations were demonstrated (see Figures 3 and 4). Casio's relay computer 14-B[10] announced in1959 was also exhibited and demonstrated. Demonstration sets for relay circuits operations were prepared by Michihiro Hashizume of NII. The tour to Fujitsu Kawasaki Works in Kawasaki City was arranged through collaboration with Fujitsu to show live demonstrations of the relay computer FACOM 138A.[11] This was developed in 1960 and is preserved in moving state. Students verified their relay computer programs they programmed (see Figure 5).

Figure 5. Verification of relay computer programs on FACOM 138A. (Courtesy of Ridai Museum.)

In Japan, Akira Nakashima and Masao Hanzawa published the paper on the switching theory for relay network analysis using the algebra corresponding to Boolean one in 1936,[12] prior to C. E. Shannon's paper for two years. Their work was inherited by researchers at Electrotechnical Laboratory (ETL). ETL prototyped a relay computer ETL Mark I,[13] the first Japanese automatic computer, in 1952. They developed a full-scale automatic relay computer ETL Mark II[14] with 22 253 relays in 1955.

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