

Regenerative Memory Encyclopedia Article

Regenerative Memory

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Regenerative Memory

Regenerative memory is any form of **data storage** which requires its contents to be refreshed or regenerated periodically. The first such device ever to be incorporated in a digital computer was the drum capacitor **memory** of the **Atanasoff-Berry Computer** (ABC), built 1942 and widely regarded as the first true electronic computer. The ABC's regenerative memory consisted of two small drums (about the size of coffee cans) spun by an electric motor and studded over their outer surfaces with capacitors. The charge (or lack thereof) on each capacitor represented a **bit** of information. As the drums rotated, charge leaked naturally from their capacitors (all capacitors lose charge over time). Lest the information stored on the drums disappear, a special circuit checked each capacitor once per revolution to see if it was charged: if it was, the circuit recharged the capacitor, preserving the information for another revolution of the drum.

The inconvenience of having to regenerate the contents of the drum memory was compensated by the speed with which **data** could be accessed from the drum, the relative cheapness of the solution, and the relatively high density of the storage system (bits per cubic inch) compared to other methods available at the time (e.g., vacuum tubes).

Despite numerous revolutions in computing technology since 1942, memories comprised of leaky capacitors continue to be a feature of virtually all computers. The CMOS (complementary metal-oxide **semiconductor**) DRAM (dynamic random-access memory) chips that populate most computers today function very much like the spinning drums of the ABC: each bit of information in a CMOS memory chip is stored as a charge on a microscopic capacitor. The charge tends to dissipate, so a special circuit must periodically (many times a second) read the contents of the memory and recharge its capacitors as needed. The frequency with which a DRAM chip's contents must be regenerated (or refreshed) is called its refresh rate. The reasons for using regenerative capacitive memory are essentially the same today as in 1942: high speed of **operation** and high device density. Some things *have* changed since 1942, however: the ABC regenerative memory stored a grand total of 300 bits, whereas a modern 256 MB DRAM chip stores about two billion bits. Optical regenerative memories are also a topic of research interest at this time.