Multiple-Bits-Per-Cell Voltage-Controlled Magnetic Memory

Tech ID: 29900 / UC Case 2013-004-0

SUMMARY

UCLA researchers in the Department of Electrical and Computer Engineering have developed a new random access memory read/write method that achieves new levels of speed, scalability, and memory density.

BACKGROUND

Magnetoresistive Random Access Memory (MRAM) is a non-volatile data storage method that uses pairs of magnets to store bits as opposed to electrical charge like common alternatives. MRAM offers long-term power savings and improved data retention over other, more commonly used, RAM alternatives. However, its resource-heavy read/write processes have limited its widespread use. A large transistor is necessary to generate the large currents necessary to change a magnet's polarity each time information is written to a memory cell. The space consumed by these large transistors reduces memory density, and the large currents sent through magnets cause significant energy losses. Therefore, new read/write approaches are necessary to truly access the benefits of MRAM.

INNOVATION

UCLA researchers have developed Magnetoelectric Random Access Memory (MeRAM), which exceeds the performance of the standard MRAM in three key areas. MeRAM improves MRAM memory density by reducing the hardware necessary for reading and writing to memory cells. Additionally, clever rearranging of memory arrays gives MeRAM a read/write speed advantage over MRAM. Finally modifications made to achieve higher speeds and memory densities with MeRAM have improved the scalability of magnet-based RAM technology.

APPLICATIONS

- CMOS technology
- Microprocessors and microcontrollers
- Performance computing
- Consumer computing

ADVANTAGES

- Improved memory density
- Higher read/write speed and efficiency
- Enhanced storage scalability

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,450,020	09/20/2016	2013-004

RELATED MATERIALS

- K. L. Wang, H. Lee, and P. K. Amiri, "Magnetoelectric Random Access Memory-Based Circuit Design by Using Voltage-Controlled Magnetic Anisotropy in Magnetic Tunnel Junctions," IEEE Transactions on Nanotechnology, vol. 14, no. 6, pp. 992–997, 2015.

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OTHER INFORMATION

KEYWORDS

random, access, memory, magnetoelectric, magnetoresistive, MRAM, MeRAM, computer, computing, performance, density, scalability, scale, scalable, speed, read, write, magnet, resistance, current, device, CMOS, complementary, metal, oxide, semiconductor, mic

CATEGORIZED AS

- **Computer**
  - Hardware
- **Engineering**
  - Engineering
- **Semiconductors**
  - Other

RELATED CASES

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