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Multi-state Spin Switch Device Having a Plurality of Output Signal Levels and Fabrication Thereof

A nanomagnet-based spin device offering multi-level outputs for denser memory, logic, and hardware PUFs.

Researchers at Purdue University have developed a multi-state spin device that offers a plurality of data storage and output signal levels. Novel approaches to fabricate the device have also been developed. This technology is controlled by independently changing the sign and amplitude of two input currents, as well as the readout voltages of the spin device output circuitry.

This technology developed by Purdue researchers provides physicists, material scientists, and engineers with a novel and versatile spin device capable of dispensing a plurality of output signal levels. The spin switch allows neural networks to be constructed with purely passive interconnections without intervening clocks or amplifiers. This technology can even be controlled by magnetic exchange coupling mechanisms with neighboring nanomagnets, GHSE currents, or spin torque currents. Moreover, the novel spin switch device provides a dramatic increment in memory storage density and logic signal outputs. The multi-state spin device can be employed to generate physically unclonable functions (PUF), a hardware solution for secure and trusted microelectronics.

Technology Validation:

Purdue Researchers deployed 8 nanomagnets to demonstrate the spin device's working principles.

Advantages:

-Novel and versatile device that provides a plurality of output signal levels

-Can be controlled using GHSE, spin torque currents, or neighboring nanomagnets

Technology ID
2024-MARI-70596

Category
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Digital Health & Medtech/Implantable Medical Devices
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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-Provides a dramatic increment in memory storage density and logic signal outputs

Applications:

-Spintronic devices

-Logic and memory devices

TRL: 3

Intellectual Property:

Provisional-Patent, 2024-02-29, United States

Keywords: Ammunition, explosives, Materials and Manufacturing, Mechanical Engineering, Metal-free