Non-volatile Spin Switch

A charge-coupled spin logic (CSL) switch offers a low-power alternative to conventional transistors, enabling robust long-distance communication for implementing complex logic circuits and artificial neural networks.

Spin electronics exploit the intrinsic spin of an electron as a means of transmitting and storing information. In metal, the spin of the electrons can be polarized into a certain direction to magnetize the object, so switching between polarities can provide a means for binary-state devices. This technology has seen limited use in memory applications, such as hard drives and random access memory, but logical devices would also greatly benefit from the low-power usage and speed of spintronics.

Purdue University researchers have designed a charge-coupled spin logic (CSL) switch that is capable of logical operations. Unlike all-spin logic (ASL) devices, this switch uses electric currents to communicate spin values over longer distances more robustly. This design uses less power than conventional transistors and allows for the design of hybrid analog/digital devices, which combine conventional and spintronic components. Multiple switches can be configured to perform Boolean logic functions or to create an artificial neural network with voltage-adjustable weights.

Advantages:

-Uses less power than conventional methods

-More robust communication over longer distances

Potential Applications:

-Implementing logic circuits, Boolean and non-Boolean

TRL: 2

Intellectual Property:

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