BPM Applied to MRAM

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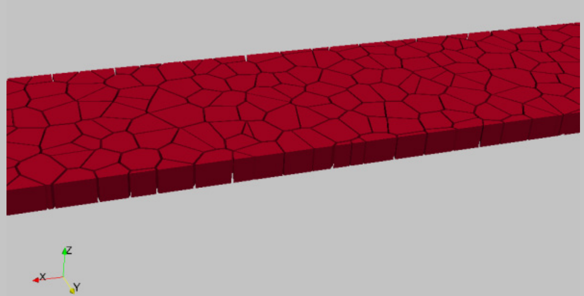
Storage capacities have reached their limitations and new technology is being developed to overcome that. In magnetic recording with BPM, the information is stored as the magnetization state assigned to each patterned bit. BPM recording combined with heat-assisted methods is envisioned as the next generation technology for magnetic information storage, which would allow achieving areal densities of up to 10 terabit per square inch, which is over an order greater than the current state of the art. This increase is critical for responding to the growing demand for storage capacities. Patterning films is one of the only ways of allowing the stability of a grain's magnetization while still controlling the size of the grain and its anisotropy. The codes I will be developing will contribute to understanding the performance of BPM and designing better BPM systems. Specifically it will allow studying BPM designs based on strong exchange-coupled grains.

Bit Patterned Nanowire (1)



Bit Patterned Nanowire (2)

MRAM technology is based on the ability to use current (and spin polarized current) to switch magnetic domains. MRAM is envisioned to be an alternative for DRAM, which would revolutionize the ways memory is handled in computing systems. MRAM is non-volatile and it requires significantly less power than DRAM. For example, the overall power consumption in mobile devices using MRAM (instead of DRAM) would around 40% smaller, which is a major power reduction. My work will contribute to the study of mechanisms for reducing the current required for switching MRAM magnetic elements, which is one of major requirements for making MRAM practical.

The proposed research is also important to broader computing and information storage areas. Micromagnetics is vital in computer technology directly related to electrical engineering. The micromagnetic simulators also can impact other computational fields, such as molecular dynamics, fluid dynamics, and electromagnetics, as many of the numerical operators in these areas are identical to those appearing in micromagnetics. Understanding of magnetization dynamics would contribute to more general understanding of fundamental properties of materials.