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Reliable switching in MRAM and multiferroic logic KAMARAM MUNIRA, Charles L. Brown Department of Electrical and Computer Engineering, University of Virginia, SUPRIYO BANDYOPADHYAY, Department of Electrical and Computer Engineering, Virginia Commonwealth University, JAYASIMHA ATULASIMHA, Department of Mechanical Engineering , Virginia Commonwealth University, EUGENE CHEN, Grandis, Inc., AVIK W. GHOSH, Charles L. Brown Department of Electrical and Computer Engineering, University of Virginia — Low reliable writing in spintronic devices limits their applicability in the automotive and defense industries. Coupling stochastic macromagnetic simulator with quantum transport, we show how greater reliable switching can be achieved in MRAM and multiferroic logic. Using a combination of spin-transfer torque and small applied perpendicular field in MRAM, the error rate can be considerably reduced for a given voltage pulse. In multiferroic logic, strain plays the role of the magnetic field. Information is passed along an array of nanomagnets (NM) (magnetostrictive + piezoelectric layers) through dipole coupling with neighboring NMs. A low voltage applied to the piezoelectric element causes the NM's magnetization to switch to its hard axis. Upon releasing the stress, the magnetization of the NM relaxes to the easy axis, with its final orientation determined by the dipolar coupling with the left NM, thus achieving a low power Bennett clocked computation. In the face of stagnation points along the potential energy landscape, the success rate of the straintronic switching can be controlled with by how fast the stress is removed from the NM. (Funding: DARPA, GRANDIS, NSF-NEB).

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