Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Implications of stochastic magnetization dynamics on reliability of dipole coupled nanomagnetic logic[1] MOHAMMAD SALEHI FASHAMI, JAYASIMHA ATULASIMHA, SUPRIYO BANDYOPADHYAY, The Virginia Commonwealth University — Straintronic nanomagnetic logic (SML), where Boolean computation is elicited from dipole coupled multiferroic nanomagnets switched with electrically generated strain, has emerged as an extremely energy-efficient computing paradigm. We have studied the reliability of such logic circuits by computing the gate error rates in the presence of thermal noise by simulating switching trajectories with the stochastic Landau-Lifshitz-Gilbert (LLG) equation. In addition, we examine the lower bound of energy dissipation as a function of switching error and explain how the out-of-plane excursion of the magnetization vector leads to excess energy dissipation over this bound for a given switching error. This analysis is performed to understand the connection between reliability and energy dissipation for a single switch and then extended to larger nanomagnetic logic circuits to assess the viability of dipole coupled SML.

[1]This work is supported by the US National Science Foundation under the SHF-Small grant CCF-1216614, NEB 2020 grant ECCS-1124714 and by the Semiconductor Research Corporation (SRC) under NRI Task 2203.001.

Mohammad Salehi Fashami
The Virginia Commonwealth University

Date submitted: 09 Nov 2012 Electronic form version 1.4