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Multi-parameter geometrical scaledown study for energy optimization of MTJ and related spintronics nanodevices[1] I. A. H. FARHAT, Khalifa University, Abu Dhabi, UAE, C. ALPHA, Cornell University - CNF, Ithaca, NY, USA, E. GALE, University of Bath, Bath, UK, D. Y. ATIA, Khalifa University, Abu Dhabi, UAE, A. STEIN, BNL-CFN, Upton, NY, USA, A. F. ISAKOVIC, Khalifa University, Abu Dhabi, UAE — The scaledown of magnetic tunnel junctions (MTJ) and related nanoscale spintronics devices poses unique challenges for energy optimization of their performance. We demonstrate the dependence of the switching current on the scaledown variable, while considering the influence of geometric parameters of MTJ, such as the free layer thickness, t_{free}, lateral size of the MTJ, w, and the anisotropy parameter of the MTJ. At the same time, we point out which values of the saturation magnetization, M_s, and anisotropy field, H_k, can lead to lowering the switching current and overall decrease of the energy needed to operate an MTJ. It is demonstrated that scaledown via decreasing the lateral size of the MTJ, while allowing some other parameters to be unconstrained, can improve energy performance by a measurable factor, shown to be the function of both geometric and physical parameters above. Given the complex interdependencies among both families of parameters, we developed a particle swarm optimization (PSO) algorithm that can simultaneously lower energy of operation and the switching current density. Results we obtained in scaledown study and via PSO optimization are compared to experimental results.

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