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Enhancement in spin-torque efficiency by nonuniform spin current generated within a tapered nanopillar spin valve P.M. BRAGANCA, O. OZATAY, A.G.F. GARCIA, O.J. LEE, D.C. RALPH, R.A. BUHRMAN, Cornell University — When modeling spin torque related phenomena, it is generally assumed that the polarization of the incident current is spatially uniform and invariant in time across the surface of the free layer nanomagnet. This is not necessarily the case for a relatively thick, low saturation magnetization reference layer that is patterned as part of a nanopillar structure, where the role of the reference layer on the spin torque dynamics of the system is considerably more complex. Here, we discuss the results of spin-torque micromagnetic simulations, confirmed by both dc and short-pulse switching measurements of nanopillar spin valve structures, which reveal that the use of this type of reference layer can result in non-uniform polarization of the current that impinges onto the free layer. This effect can enhance magnetic reversal in the nanosecond-switching regime over the case of a fixed and uniformly magnetized reference layer, substantially reducing the current amplitude required for magnetic reversal with a given ns pulse-width. We will discuss these results, which differ substantially from descriptions provided using macrospin approximations, and describe a nanopillar spin-torque device configuration that simulations and experiments indicate could be quite effective in reducing the spin torque switching current for MRAM applications.

Patrick Braganca
Cornell University

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