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Dynamic and temperature effects in spin-transfer switching[1]
DORIN CIMPOESU, HUY PHAM, University of New Orleans, ALEXANDRU STANCU, Iasi University, LEONARD SPINU, University of New Orleans — Recently, the current-induced spin-transfer torque has been proposed as a convenient writing process in high density magnetic random access memory. With increasing demand on the access time, the current pulse shape become important. Also, with memory area density increasing and the memory cell size further shrinking the study of thermal fluctuations in these magnetic structures becomes of extreme importance for their recording thermal stability. In this paper we have studied the dynamic switching in a spin-transfer memory and its dependence on thermal effects. The magnetic layers are assumed to be in the shape of ellipsoids, and each magnetic layer is assumed to be a single domain. The model is based on stochastic Landau-Lifshitz-Gilbert equation, which is numerically integrated, and the switching diagrams, as a function of current pulse amplitude and duration, are presented. Instead of a clear border between switching and non-switching areas we have a transition region, with a layer-like structure with switching/non-switching areas, where the final state is sensitive to current pulse amplitude and duration, to damping constant, and to thermal fluctuations. The extent of the instability region is increasing with the applied current sweep rate.

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