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Energetic analysis of fast magnetic switching ANDRZEJ STANKIEWICZ, NVE Corporation — The speed of magnetic switching is an important parameter for many devices, like magnetic random access memory (MRAM) cells, or hard drive disk/heads. Traditionally switching processes have been evaluated by solving the Landau-Lifshitz (LLG) equation numerically. Criteria of successful switching were defined in phase space (instantaneous magnetic moments), or required full system relaxation. This presentation introduces another look at the switching processes, based on an energetic approach. The main idea is to split the total transient energy of the system into two parts: E_s, which includes switching stimulus only (e.g. external pulse field), and E_0 - covering effects important for final state. Monitoring a single value E_0, as LLG integration progresses, allows for detection of switched states. The method shows its full power in the case of magnetic nanostructures, which have a relatively simple energetic landscape of relaxed states (no magnetic domains), but may show very complex dynamical configurations. Another advantage is a possibility to account for finite temperature in switching criteria. The concept is illustrated by simulations of single spin and MRAM cell switching.

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