On a model of magnetization switching driven by a spin current: modeling and numerical simulations

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This is a joint work with Naoufel Ben Abdallah, Elise Fouassier and David Sanchez.

Abstract: We study a model, introduced in [1], of magnetization switching induced by a spin polarized current without applying an external magnetic field. It consists of a coupled system for the local magnetization (that satisfies a Landau-Lifshitz equation with an additional spin torque) and for the spin density (that satisfies a diffusion equation with a term for the procession phenomenon around the magnetization).
We first write the one dimensional model in an adimensionalized form, using a small parameter ϵ. We then explain the various time and space scales involved in the studied phenomena. Taking into account these scales, we construct an appropriate numerical scheme, that allows us to recover numerically various results of physical experiments. Finally, we perform a formal asymptotic study as ϵ tends to 0. We thus obtain an approximate limit model that we compare with the original model via numerical simulations.

References

[1] S. Zhang, P. M. Levy and A. Fert, *Mechanisms of spin-polarized current-driven magnetization switching*, Phys. Rev. Lett. **88**(23), 2002.