Approximation of Landau-Lifshitz-Gilbert Equations

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The Landau-Lifshitz-Gilbert equation describes magnetic behavior in ferromagnetic materials. The construction of numerical strategies to approximate weak solutions for this equation is made difficult by its top order nonlinearity and nonconvex constraint. In this talk, we discuss necessary scaling of numerical parameters and provide a refined convergence result for a fully explicit scheme first proposed by Alouges and Jaisson. The conditions on the time step size turn out to be very restrictive and this motivates the discussion of an implicit scheme which allows unconditional convergence. As application, we numerically study finite time blow-up in two dimensions for the regime of small damping parameter and indicate generalizations of the approximation scheme for the simulation of Maxwell-Landau-Lifshitz-Gilbert equations.

[1] Sören Bartels and Andreas Prohl: *Convergence of an implicit finite element method for the Landau-Lifshitz-Gilbert equation*, Preprint
[2] Sören Bartels, Joy Ko and Andreas Prohl: *Numerical approximation of the Landau-Lifshitz-Gilbert equation and finite time blow-up of weak solutions*, Preprint
[3] Sören Bartels: *Stability and convergence of finite element approximation schemes for harmonic maps*, SIAM J. Numer. Anal. 43 (1) 2005.

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