Karlsruhe Institute of Technology

Seminar of the Work Group
Nonlinear Partial Differential Equations
SS 24

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On the (In)stability of Several Structures for the Landau-Lifshitz-Gilbert Equation on a Nanowire

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Abstract

We are interested in the Landau-Lifshitz-Gilbert equation (LLG) with Dzyaloshinskii-Moriya interaction (DMI) on a nanowire, with or without external magnetic field H_{ext}. This equation features structures connecting $-e_1$ to $+e_1$ (or conversely) called domain walls, which are stationary solutions when $H_{ext} = 0$ and precess explicitly when $H_{ext} = h(t)e_1$. This structure is asymptotically stable, and it is conjectured that generic solutions of LLG decompose into domain walls over time. In this talk, we will focus on two related structures. The first is the 2-domain wall, consisting of two consecutive opposite domain walls. I will show that these structures are also asymptotically stable when initially separated and when H_{ext} drives the domain walls away from each other. This work is in collaboration with Raphaël Côte. The second structure is the stationary solution when $H_{ext} = h_0 e_1$ with constant h_0. I will show that this solution is unstable, but the numerical simulations of the evolution from perturbations of this solution still provide valuable insights regarding the two previous results.