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NUMERICAL METHODS FOR INERTIAL SPIN DYNAMICS IN FERROMAGNETS AND ANTIFERROMAGNETS

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We consider the numerical approximation of inertial extensions of the Landau–Lifshitz–Gilbert (LLG) equation that are relevant for the modeling of the dynamics of the magnetization in ferromagnets at subpicosecond time scales and the dynamics of the order parameter (the so-called Néel vector) describing the magnetic state of an antiferromagnet [1, 2]. To discretize the problems, we propose fully discrete numerical schemes, implicit in time and based on first-order finite elements in space, which preserve the inherent unit-length constraint of the extended LLG equations at the vertices of the underlying mesh, and generate approximations that converge towards weak solutions of the problems. Numerical experiments validate the theoretical results and show the applicability of the methods for the simulation of magnetic processes involving ferromagnets and antiferromagnets.

REFERENCES

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