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Including Magnetostriction in Micromagnetic Models

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The magnetic anomalies that identify crustal spreading are predominantly recorded by basalts formed at the mid-ocean ridges, whose magnetic signals are dominated by iron–titanium-oxides ($\mathrm{Fe}_{3-x}\mathrm{Ti}_x\mathrm{O}_4$), so called "titano-magnetites", of which the $\mathrm{Fe}_{2.4}\mathrm{Ti}_{0.6}\mathrm{O}_4$ (TM60) phase is the most common. With sufficient quantities of titanium present, these minerals exhibit strong magnetostriction. To date, models of these grains in the pseudo-single domain (PSD) range have failed to accurately account for this effect. In particular, a popular analytic treatment provided by Kittel (1949) for describing the magnetostrictive energy as an effective increase of the anisotropy constant can produce unphysical strains for non-uniform magnetizations. I will present a rigorous approach based on work by Brown (1966) and by Kroner (1958) for including magnetostriction in micromagnetic codes which is suitable for modelling hysteresis loops and finding remanent states in the PSD regime. Preliminary results suggest the more rigorously defined micromagnetic models exhibit higher coercivities and extended single domain ranges when compared to more simplistic approaches.