Temperature effects in the Object Oriented Micromagnetic Framework (OOMMF)

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To simulate the movement of the macroscopic magnetic moment in ferromagnetic systems under the influence of elevated temperatures, the stochastic version of the Landau-Lifshitz (LL) or the Landau-Lifshitz-Gilbert equation with a spin density of one per unit cell has to be used. To apply the stochastic LL to micromagnetic simulations, where the spin density per unit cell is generally higher, a conversion has to be performed. Details can be found in the literature[1]. Briefly:
To determine the scaling between the physical temperature (T_{eff}) and the input parameter used as simulation temperature (T_{sim}) the lattice constant (a_{eff}) and the length of a elementary simulation cell (a_{sim}) has to be set into relation. The temperature T_{sim} as used in the simulation as input parameter can be determined from the physical temperature T_{eff} by:

$$T_{sim} = \frac{a_{sim}}{a_{eff}} T_{eff} \tag{1}$$

The range where scaling can be applied one has to consider the temperature effects on the exchange length of the system.[1] Cell sizes of 1-2 nm in combination with time steps around 1 fs are a reasonable starting points. Sample files for OMMF are attached. These files can be used to determine the Curie temperature for the classical bulk magnets, iron, nickel and cobalt.

References

1. Hahn, M. B. Temperature in micromagnetism: Cell size and scaling effects of the stochastic Landau–Lifshitz equation. *Journal of Physics Communications* **3**, 075009 (2019). DOI 10.1088/2399-6528/ab31e6.