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Behavioral Model of Spin-Transfer Torque Driven Oscillation in a Nanomagnet BENJAMIN BUFORD, ALBRECHT JANDER, PALLAVI DHAGAT, Oregon State University — We present a model written in Verilog-A, a behavioral description language, for spin-torque driven oscillations in a nanomagnet. Recent experiments have shown that spin-polarized current passing through a nanomagnet can cause magnetic dynamics from transfer of spin angular momentum. This can result in steady state oscillation of the magnetization at microwave frequencies [1]. Such spin torque oscillators are of interest due to the ability to rapidly tune their operating frequency by adjusting the applied magnetic field and their compatibility with existing CMOS fabrication methods. Our model is based upon the Landau-Lifshitz-Gilbert dynamics of a single- domain nanomagnet [2] and includes thermal agitation. We demonstrate the ability to model small angle, large angle, and out-of-plane precession. Additionally, we characterize the field and current boundaries between these regimes. Our Verilog-A model can be used in industry standard simulation tools alongside CMOS device models to simulate circuits that combine spintronic devices with CMOS control and processing circuitry.

[1] S. I. Kiselev et al., Nature, Vol. 425, pp. 380(3), (2003).
[2] L. Engelbrecht, Ph.D. Dissertation, Dept. Elect. Eng., Oregon State Univ., Corvallis, OR, (2011).

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