Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Spintronics r.f. oscillator driven by magnetic field feedback ASHWIN TULAPURKAR, Department of Electrical Engineering, Indian Institute of Technology-Bombay, Mumbai 400076, India, DINESH DIXIT, Department of Physics, Indian Institute of Technology-Bombay, Mumbai, India, KATSUNORI KONISHI, Graduate School of Engineering Science, Osaka University, Toyonaka, Osaka, Japan, C.V. TOMY, Department of Physics, Indian Institute of Technology-Bombay, Mumbai, India, YOSHISHIGE SUZUKI, Graduate School of Engineering Science, Osaka University, Toyonaka, Osaka, Japan — Magnetic tunnel junctions (MTJ) can be used as nano-scale rf oscillators using spin-transfer torque effect. Here we present an alternative novel mechanism of "magnetic field feedback" for driving MTJs into precessional states. To realize this effect, MTJ needs to be fabricated on top of a co-planar wave-guide. A dc current is passed through MTJ to produce a fluctuating voltage across it as a combination of thermal fluctuations of free layer and magneto-resistance effect. This voltage is applied across co-planar wave-guide to create a fluctuating magnetic field which acts on the free layer to enhance its fluctuations. If the dc current exceeds a critical value, precessional states of free layer are excited. We have derived expression for the critical current using lineralized LLG equation, modified to include the "feedback" magnetic field. We have verified the feedback effect by numerical simulation of stochastic LLG equation including random magnetic field: we find that the damping of the free layer can be increased/decreased by applying –ve/+ve dc current. Simulations show that by applying dc current more than critical current, large amplitude oscillations with high quality factors are possible.

Ashwin Tulapurkar
Department of Electrical Engineering,
Indian Institute of Technology-Bombay, Mumbai 400076, India

Date submitted: 27 Nov 2012 Electronic form version 1.4