

EA09

Field-Like Spin Torque Term Governs Enhanced Synchronization in Magnetic Tunnel Junction based Spin Torque Oscillator

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The Spin Torque Oscillator (STO) shows great promise as a frequency generating device at microwave frequencies. Due to the limited output of GMR based STO it is generally accepted Magnetic Tunnel Junction (MTJ) based STO will be needed and that several STOs will have to be phase locked to reach sufficient output power. In this work we use the macrospin model to study the effect of field-like torque term coefficient bJ [1] on the synchronization of MTJ based STOs.

Fig. 1 shows the precession frequency as a function of bJ . The lower left and right insets show the system energy difference per cycle versus the phase difference between an injected AC current and the MTJ based STO for in-plane and out-of-plane oscillation [2,3]. The most notable feature is that the preferred phase shift depends strongly on the bJ term and thus will significantly affect the synchronization of electronically coupled STOs [4]. This is indeed observed in the synchronization diagram [the upper inset figure] where synchronization region grows from 1% to 40% when bJ increases from zero to 25% of aJ (in-plane torque coefficient).

In conclusion, we have investigated the effect of field-like torque on the I-V phase in the STO based circuit and the corresponding impact on the synchronization of MTJ based STOs. MTJ based STOs have the double benefit of both a larger intrinsic signal and a strong propensity for synchronization.

Support from The Swedish Foundation for Strategic Research, The Swedish Research Council, and the Göran Gustafsson Foundation is gratefully acknowledged.

REFERENCES

- [1] Z. Li *et al.*, Phys. Rev. Lett, 100, 246602 (2008).
- [2] Yan Zhou, J. Persson, and Johan Åkerman, J. Appl. Phys., 101, 09A510, (2007).
- [3] Yan Zhou, J. Persson, S. Bonetti, and Johan Åkerman, Appl. Phys. Lett. 92, 092505 (2008).
- [4] J. Persson, Yan Zhou, and Johan Åkerman, J. Appl. Phys., 101, 09A503, (2007).

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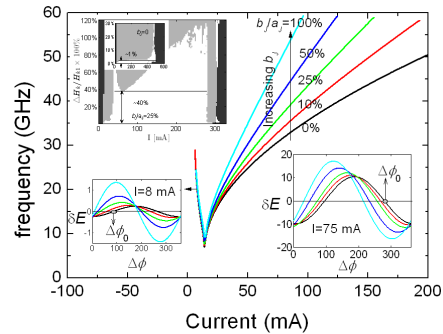


Fig. 1. Frequency versus the driven current for different ratios of bJ to aJ .

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