MAR09-2008-006907

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Synchronization of spin-torque oscillators via phase-shift control[1]

JOHAN AKERMAN, Göteborg University and Royal Institute of Technology

The Spin Torque Oscillator (STO) shows great promise as a frequency generating device at microwave frequencies. However its very limited output power has to be significantly improved for any realistic application. One possibility is the synchronization of two or more STOs to both increase the microwave power and further increase Q. We have recently demonstrated an intrinsic preferred phase shift between an STO and an injected RF current [1, 2]. This phase shift has direct implications for current-mediated synchronization of serially connected STOs [3]. It is exactly at this phase shift where the multi-STO synchronized state develops the highest robustness and by tuning the total circuit I-V phase shift, synchronization can be enhanced by close to 2 orders of magnitude. Since our initial work, we have now determined both the phase shift and the enhancement factor in all types of STOs (standard, perpendicular [4], wavy torque [5], tilted polarizer [6]). More recently we have also found that the perpendicular torque component present in magnetic tunnel junctions enhances synchronization through a decrease of the intrinsic phase shift. These findings are expected to be critical for future applications and will hopefully accelerate the realization of useful STO-based microwave devices.

References

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[1]Supported by The Swedish Foundation for strategic Research, The Swedish Research Council, The Göran Gustafsson Foundation, and the Knut and Alice Wallenberg Foundation. Johan Åkerman is a Royal Swedish Academy of Sciences Research Fellow.