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Network Analyzer Measurements of Spin-Torque Dynamics LIN XUE, CHEN WANG, YONGTAO CUI, R.A. BUHRMAN, D.C. RALPH, Cornell University — A microwave current flowing through a magnetic tunnel junction (MTJ) produces an oscillating spin torque. This oscillating spin torque is able to excite resonant magnetic dynamics and produce an oscillating resistance. The oscillating resistance combined with an applied DC current can generate a microwave voltage signal at the same frequency as the input microwave signal. We show that a network analyzer measurement of the amplitude and phase of this signal provides a simple way to make a quantitative measurement of the strength and direction of the spin transfer torque vector in MTJs at non-zero biases, the regime of primary interest for applications. Compared with a previous time-domain technique for measuring the spin torque vector, this technique requires no specialized equipment and provides roughly similar sensitivity. Compared to dc-detected spin-torque ferromagnetic resonance, the network-analyzer method is free of artifacts at high bias.

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