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Effect of Bias on Spin-Transfer Torque in Magnetic Tunnel Junctions. IOANNIS THEODONIS[1], ALAN KALITSOV, NICHOLAS KIOUSSIS, Department of Physics, California State University, Northridge, MAIRBEK CHSHIEV, W.H. BUTLER, MINT Center, University of Alabama — The current-induced magnetic switching in non-collinear magnetic tunnel junctions (MTJ) through the spin-transfer torque(STT) provides the possibility of manipulating nonvolatile MRAM, without applying cumbersome magnetic fields. Using tight-binding calculations and the non-equilibrium Keldysh formalism, we have studied the effect of applied bias on the components of the STT, parallel $T_{||}$, and perpendicular, $T_{\perp}$, to the interface. We show that depending on the exchange splitting, $T_{||}$ may exhibit a non-monotonic bias dependence: it may change sign without a sign reversal in current, and in some cases it may even have a quadratic bias dependence. Second, we show that $T_{||}$ is given by the difference in spin currents between the FM and anti-ferromagnetic (AF) configurations. Third, the bias dependence for the spin current for the FM (AF) alignment is shown to have a linear (quadratic) bias dependence, whose origin lies on the symmetric (asymmetric) nature of the barrier. The interplay of the spin currents for the FM and AF configurations can lead to a rich behavior of the $T_{||}$ on bias. Finally, we find that, $T_{\perp}$(non-equilibrium exchange coupling), is comparable in size with $T_{||}$, and has a quadratic bias dependence.

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