SPIN ANGULAR MOMENTUM TRANSFER IN MAGNETIC NANOSTRUCTURE

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ABSTRACT

Spin angular momentum transfer, or spin transfer, is a short notion of the transfer of spin angular momentum between the spin polarized current and the magnetization of ferromagnetic condensates. Spin transfer effect in ferromagnetic nanostructures, such as Magnetic Tunnel Junctions (MTJ) and Spin Valves, is studied in this dissertation. Spin current generates spin transfer torque in ferromagnets, which can induce magnetization reversal, spin wave emission, as well as self-sustained magnetization precession in the presence of magnetic field.

The magnetization oscillation in spin valves is referred as the spin transfer oscillator (STO). We investigated the magnetization dynamics in STO. We applied a universal method, Melnikov Integral, to determine three different dynamical phases in STO, that is, limit cycles, synchronization and chaos. Finite temperature may have significant effect on STO dynamics. We studied the thermal effect on limit cycles and chaos.

In MTJ, in addition to spin transfer, energy transfer effect is studied on the basis of energy conservation. The effect of energy transfer on spin transfer induced magnetization switching is modeled in terms of an effective magnetic temperature.