Current-induced magnetic switching and dynamics in spin-valves

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Transfer of spin from conduction electron system to localized magnetic moments can generate transitions between different magnetic equilibrium states of the system. This phenomenon is called 'current-induced magnetic switching'. At some conditions, however, the spin-transfer torque may cause transition to precessional states of microwave frequency, where the energy is pumped from a voltage source to the magnetic system. Some of the models used for description of the spin transfer torque will be analyzed. Apart from this, the current-induced switching and dynamics will be presented and discussed in details within a macro-spin model used in description of switching phenomena in metallic spin valves. Moreover, close correlation with normal and inverse giant magnetoresistance effect will be considered in view of recent experimental data. Particular attention will be paid to structures, where microwave precessional states can be induced by current in the absence of external magnetic field. Since the current-induced magnetic switching is a general phenomenon, it can occur not only in metallic spin valves, but also in magnetic tunnel junctions, spin valves based on magnetic particles, quantum dots, or molecules. Some of these spin valves will be considered in more details.

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