Abstract phd thesis

Whithin the scattering matrix approach we study the spin polarized transport and the spin torque in magnetic barriers under the effect of dc voltage. In this contex the influence of geometric and magnetic parameters (like an external magnetic field or magnetization) on the conductance and on the spin currents will be analysed. Both the case of a barrier of finite width or two delta barriers was considered . Different aspects involved in the properties of spintronics interest are considered and comparison with recent experiments are reported.
In this thesis we studed the adiabatic quantum pumping and quantum size effects of spin-torque in a magnetic tunnel junction within a scattering matrix approach. Quantum size effects are predicted in the presence of a dc bias as a function of the thickness of the normal metal layer inserted between two magnetic layers and of the fixed magnetic layer. In the presence of ac voltages, the results for the spin-torque show a peculiar magnification effect and advantages of spin-torque pumping in actual devices are also discussed.
Moreover, with scattering matrix approach the conductance and the spin transfer torque in ferromagnetic /superconductor/ ferromagnetic (F/S/F) or normal metal/ superconductor/ normal metal (N/S/N) heterostructures are studed. We analyze the quantum effects on the conductance and /or spin-torque as function of the width of the superconducting layer, the barrier heights and the coherence length. We also address the problem of the role of Andreev reflections within an extended Bogoliubov – De Gennes approach. The results are discussed in connection with recent experiment on spin valves.