Domain structure related Lorentz magnetoresistance in thin films

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Contributions of domain walls and domain structure to the magnetoresistance have been investigated and discussed intensively in the past years. Recent experiments give evidence of the existence of a domain wall resistance (DWR) in thin films of FePt, Fe and Co, along with other materials. For room temperature, results can be explained rather consistently as an analogue of the GMR effect. At lower temperatures, DWR in Fe, Co and FePt show a more complex pattern. Results for the DWR seem to depend on material and experimental setup. In particular, the DWR in iron film has shown to be "negative", i.e. the resistivity is enhanced by the presence of domain walls. In contrast, the DWR in Co films has been shown to increase. This effect has been related to an effect of the Lorentz force on charge carriers in a thin film in the presence of a domain structure and surface scattering. In this work, numerical results on the Lorentz magnetoresistance in various domain structures are presented. The domain structures and experimental setups of recent experiments on Fe and Co films have been modeled. Results suggest a simple explanation of both the negative DWR in iron films and the increase of DWR with decreasing temperature in Co films. More generally, three distinct domain-structure related magnetoresistance effects can be distinguished.