Seminar on Magnetization processes in materials

Lecturer: Giorgio Bertotti (INRIM, Torino, Italy)

When: 9 september 2008; 10.00-13.00 : Module I, 14.00-17.00: Module II

Place: Jozef Plateaustraat 22, B-9000 Gent, Auditorium E-SS

Fee: no fee, but advanced registration required (by email luc.dupre@ugent.be)

Content of seminar

MODULE I - Hysteresis modeling

I.A. General properties of hysteresis in magnetic materials
- scalar versus vector hysteresis
- hysteresis loops and magnetization curves
- hysteresis losses
- branching and field-history dependence in magnetization curves
- local and nonlocal memory, return-point memory
- thermal relaxation effects

I.B. Dynamics and hysteresis in a bistable potential
- viscous-type dynamics and rate-independent limit
- stability and metastability of equilibrium points
- memory
- graphical construction of hysteresis loop
- Barkhausen jumps, energy dissipation, and hysteresis loss
- rate-dependent effects

I.C. Collections of bistable units and the Preisach model
- idealized bistable units
- Preisach plane
- Preisach distribution
- Graphical construction of magnetization curves
- return-point memory and congruency property
- application to experimental magnetization curves

MODULE II - Magnetic materials

II.A. Magnetic domains
- exchange, anisotropy, and magnetostatic energy
- energy reasons for the existence of magnetic domains
- magnetic domain walls and magnetic domain structures
- domain wall dynamics and the Barkhausen effect
- magnetization processes and magnetic hysteresis loops

II.B. Magnetic losses in metallic ferromagnets
- physical origin of loss separation

- hysteresis, classical, and excess losses
- connection between excess losses and magnetic domain structures
- interpretation of loss curves in electrical steels

II. C - Micromagnetics
- competition between exchange, anisotropy, and magnetostatic energy
- total energy minimization and magnetic domain structures
- metastable states and origin of macroscopic magnetic hysteresis
- Landau-Lifshitz equation for magnetization dynamics