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Nota di contenuto	Contents; List of abbreviations; List of panels and tables; Preface; 1 Introduction: The simplest models of magnetism; 1.1 Field and magnetization; 1.2 The circular-current model; 1.3 Paramagnetic spins; 1.4 Ising model and exchange; 1.5 The viscoelastic model of magnetization dynamics; Exercises; 2 Models of exchange; 2.1 Atomic origin of exchange; 2.1.1 One-electron wave functions; 2.1.2 Two-electron wave functions; 2.1.3 Hamiltonian and spin structure; 2.1.4 Heisenberg model; 2.1.5 Independent-electron approximation; 2.1.6 Correlations; 2.1.7 *Hubbard model; 2.1.8 *Kondo model 2.2 Magnetic ions 2.2.1 Atomic orbitals; 2.2.2 Angular-momentum algebra; 2.2.3 Vector model and Hund's rules; 2.2.4 Spin and orbital moment; 2.3 Exchange between local moments; 2.3.1 Exchange in oxides; 2.3.2 Ruderman-Kittel exchange; 2.3.3 Zero-temperature spin structure; 2.4 Itinerant magnetism; 2.4.1 Free electrons, Pauli susceptibility, and the Bloch model; 2.4.2 Band structure; 2.4.3 Stoner model and beyond; 2.4.4 *Itinerant antiferromagnets; Exercises; 3 Models of magnetic anisotropy; 3.1 Phenomenological models; 3.1.1 Uniaxial anisotropy 3.1.2 Second-order anisotropy of general symmetry 3.1.3 Higher-order

anisotropies of nonuniaxial symmetry; 3.1.4 Cubic anisotropy; 3.1.5 Anisotropy coefficients; 3.1.6 Anisotropy fields; 3.2 Models of pair anisotropy; 3.2.1 Dipolar interactions and shape anisotropy; 3.2.2 Demagnetizing factors; 3.2.3 Applicability of the shape-anisotropy model; 3.2.4 The Neel model; 3.3 Spin-orbit coupling and crystal-field interaction; 3.3.1 Relativistic origin of magnetism; 3.3.2 Hydrogen-like atomic wave functions; 3.3.3 Crystal-field interaction; 3.3.4 Quenching; 3.3.5 Spin-orbit coupling  
3.4 The single-ion model of magnetic anisotropy 3.4.1 Rare-earth anisotropy; 3.4.2 Point-charge model; 3.4.3 The superposition model; 3.4.4 Transition-metal anisotropy; 3.5 Other anisotropies; 3.5.1 Magnetoelasticity; 3.5.2 Anisotropic exchange; 3.5.3 Models of surface anisotropy; Exercises; 4 Micromagnetic models; 4.1 Stoner-Wohlfarth model; 4.1.1 Aligned Stoner-Wohlfarth particles; 4.1.2 Angular dependence; 4.1.3 Spin reorientations and other first-order transitions; 4.1.4 Limitations of the Stoner-Wohlfarth model; 4.2 Hysteresis; 4.2.1 Micromagnetic free energy  
4.2.2 \*Magnetostatic self-interaction 4.2.3 \*Exchange stiffness; 4.2.4 Linearized micromagnetic equations; 4.2.5 Micromagnetic scaling; 4.2.6 Domains and domain walls; 4.3 Coercivity; 4.3.1 Nucleation; 4.3.2 Pinning; 4.3.3 Phenomenological coercivity modeling; 4.4 Grain-boundary models; 4.4.1 Boundary conditions; 4.4.2 Spin structure at grain boundaries; 4.4.3 Models with atomic resolution; 4.4.4 Nanojunctions; Exercises; 5 Finite-temperature magnetism; 5.1 Basic statistical mechanics; 5.1.1 Probability and partition function; 5.1.2 \*Fluctuations and response; 5.1.3 Phase transitions  
5.1.4 Landau theory

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## Sommario/riassunto

Models of magnetism have been pivotal in the understanding and advancement of science and technology. The book is the first one to cover the field as a whole, complementing a rich literature on specific models of magnetism. It is written in an easily accessible style, with a limited amount of mathematics, and covers a wide range of phenomena. - ;For hundreds of years, models of magnetism have been pivotal in the understanding and advancement of science and technology, from the Earth's interpretation as a magnetic dipole to quantum mechanics, statistical physics, and modern nanotechnology. This

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