

Contents

1	General Introduction	1
1.1	Bibliography	5
2	Diluted Systems	7
2.1	Introduction	7
2.2	Annealed Models	9
2.3	Mean-Field Ising Model in a Random Field	15
2.4	The Hierarchical Random-Field Ising Model	21
2.4.1	The Imry-Ma Argument	25
2.4.2	The Hierarchical Random-Field Model	26
2.5	Griffiths Singularities	31
2.6	Symmetry-Breaking and the Spherical Model in a Random Field	35
2.7	Bibliography	38
3	Lattice Models with Competing Interactions	41
3.1	Introduction. One-Dimensional Spin Models	41
3.2	The Bak - Bruinsma - Aubry Model	47
3.3	Aubry's Treatment of the Bak- Bruinsma- Aubry Model	54
3.4	Linear Chain of Coupled Atoms and Dynamical Systems	62
3.5	The Mean-Field ANNNI Model as an Area-Preserving Map	69
3.6	Ising Models as a Mapping Problem on the Cayley Tree	74
3.7	Conclusions	83
3.8	Bibliography	84
4	Spin Glasses	93
4.1	Introduction	93
4.2	Spin Glasses. Some General Aspects	94
4.3	The Thermodynamic Limit after van Enter and van Hemmen	98
4.4	The Replica Method of van Hemmen and Palmer	102
4.5	The Negative Entropy Problem	109
4.6	Spin-Glass Models on a Cayley Tree	111
4.7	Spin-Glass on a Cayley Tree at $T = 0$	114
4.8	Spin-Glass on a Cayley Tree of Infinite Coordination	120

4.9 Random Versus Nonrandom	123
4.10 Bibliography	126
5 Quantum Lattice Models with Competing Interactions	131
5.1 Introduction	131
5.2 The Hubbard Model	132
5.3 The RVB State	140
5.4 Quantum Spin Chains with Competing Interactions	143
5.4.1 The DM Quantum Chain	148
5.4.2 Quantum Analogs of ANNNI Chains	155
5.5 Models of Localization	159
5.6 Lifshitz Tails in Quantum Disordered Systems	167
5.7 Bibliography	172
A A Brief Introduction to Dynamical Systems	177
A.1 Stability of Equilibrium Points	179
A.2 Attractors and Strange Attractors	182
A.3 The Kaplan-Yorke Attractor	185
A.4 Fractal Dimensions	190
A.5 Bifurcations	193
A.6 Area-Preserving Maps	194
A.7 Bibliography	197
B The Theorems of Aubry	199
B.1 Bibliography	204
C Bethe Ansatz and Conformal Invariance	205
C.1 The Bethe Ansatz	206
C.2 Some Aspects of Conformal Invariance	214
C.3 Bibliography	222
D Unicity of Phases, Unicity in a Sector, and Spontaneous Symmetry Breaking	223
D.1 Bibliography	229
Subject Index	231
Author Index	233