

Contents

1	The Concept of the Renormalization Group	1
1.1	Effective Theories	1
1.2	RG Flow	2
1.3	UV and IR Limits and Fixed Points	7
1.4	The Continuum Limit	10
	Bibliographical Notes	12
	References	12
2	Scalar Field Theories	13
2.1	Finding the RG Flow	14
2.2	Mapping the Space of Flows	20
	Bibliographical Notes	23
	References	24
3	RG and Perturbation Theory	25
3.1	The Background Field Method	31
3.2	Triviality	32
3.3	RG Improvement	33
	Bibliographical Notes	36
	References	36
4	Gauge Theories and Running Couplings	37
4.1	Quantum Electro-Dynamics	37
4.2	Decoupling in $\overline{\text{MS}}$	41
4.3	Non-Abelian Gauge Theories	42
4.4	Banks-Zaks Fixed Points	45
4.5	The Standard Model and Grand Unification	46
	Bibliographical Notes	49
	References	50
5	RG and Supersymmetry	51
5.1	Theories of Chiral Multiplets: Wess-Zumino Models	51
5.2	SUSY Gauge Theories	55

5.3 Vacuum Structure 60

5.4 RG Fixed Points 62

5.5 The Maximally SUSY Gauge Theory. 65

Bibliographical Notes. 69

References 70