

Contents

<i>Preface</i>	<i>page</i>	xi
<i>Conventions</i>		xiv
1 Aperitifs		1
1.1 Diffusion		1
1.2 Single-species annihilation/coalescence		4
1.3 Two-species annihilation		9
1.4 Notes		10
2 Diffusion		12
2.1 The probability distribution		12
2.2 Central limit theorem		15
2.3 Walks with broad distributions		17
2.4 Application to gravity: the Holtsmark distribution		22
2.5 First-passage properties		26
2.6 Exit probabilities and exit times		30
2.7 Reaction rate theory		37
2.8 The Langevin approach		40
2.9 Application to surface growth		44
2.10 Notes		51
2.11 Problems		51
3 Collisions		59
3.1 Kinetic theory		59
3.2 The Lorentz gas		63
3.3 Lorentz gas in an external field		70
3.4 Collisional impact		75
3.5 Maxwell molecules and very hard particles		77
3.6 Inelastic gases		81
3.7 Ballistic agglomeration		89
3.8 Single-lane traffic		92
3.9 Notes		96
3.10 Problems		97

4 Exclusion	103
4.1 Symmetric exclusion process	103
4.2 Asymmetric exclusion process	108
4.3 Hydrodynamic approach	112
4.4 Microscopic approach	118
4.5 Open systems	123
4.6 Notes	130
4.7 Problems	131
5 Aggregation	134
5.1 The master equations	134
5.2 Exact solution methods	137
5.3 Gelation	145
5.4 Scaling	153
5.5 Aggregation with input	156
5.6 Exchange-driven growth	163
5.7 Notes	167
5.8 Problems	168
6 Fragmentation	172
6.1 Binary fragmentation	172
6.2 Planar fragmentation	180
6.3 Reversible polymerization	185
6.4 Collisional fragmentation	191
6.5 Notes	195
6.6 Problems	195
7 Adsorption	199
7.1 Random sequential adsorption in one dimension	199
7.2 Phase space structure	206
7.3 Adsorption in higher dimensions	213
7.4 Reversible adsorption	220
7.5 Polymer translocation	226
7.6 Notes	229
7.7 Problems	230
8 Spin dynamics	233
8.1 Phenomenology of coarsening	233
8.2 The voter model	235
8.3 Ising–Glauber model	244
8.4 Mean-field approximation	247
8.5 Glauber dynamics in one dimension	249
8.6 Glauber dynamics in higher dimensions	258
8.7 Spin-exchange dynamics	264

8.8	Cluster dynamics	269
8.9	Notes	273
8.10	Problems	274
9	Coarsening	277
9.1	Models	277
9.2	Free evolution	280
9.3	Case studies in non-conservative dynamics	283
9.4	Final states	292
9.5	Defects	294
9.6	Conservative dynamics	302
9.7	Extremal dynamics	307
9.8	Nucleation and growth	312
9.9	Notes	317
9.10	Problems	318
10	Disorder	322
10.1	Disordered spin chain	322
10.2	Random walk in a random potential	331
10.3	Random walk in random velocity fields	339
10.4	Notes	343
10.5	Problems	344
11	Hysteresis	346
11.1	Homogeneous ferromagnets	346
11.2	Perturbation analysis	349
11.3	Disordered ferromagnets	357
11.4	Mean-field model	361
11.5	Hysteresis in the random-field Ising chain	366
11.6	Notes	370
11.7	Problems	370
12	Population dynamics	373
12.1	Continuum formulation	373
12.2	Discrete reactions	382
12.3	Small-fluctuation expansion	391
12.4	Large fluctuations	394
12.5	Notes	399
12.6	Problems	400
13	Diffusive reactions	404
13.1	Role of the spatial dimension	404
13.2	The trapping reaction	409
13.3	Two-species annihilation	414

13.4	Single-species reactions in one dimension	417
13.5	Reactions in spatial gradients	428
13.6	Notes	436
13.7	Problems	437
14	Complex networks	441
14.1	Non-lattice networks	441
14.2	Evolving random graphs	443
14.3	Random recursive trees	451
14.4	Preferential attachment	456
14.5	Fluctuations in networks	460
14.6	Notes	465
14.7	Problems	466
<i>References</i>		471
<i>Index</i>		483