

Contents

<i>Introduction</i>	<i>page viii</i>
1 Hypercyclic and supercyclic operators	1
1.1 How to prove that an operator is hypercyclic	2
1.2 Some spectral properties	10
1.3 What does the set of hypercyclic vectors look like?	15
1.4 Three examples	17
1.5 Comments and exercises	26
2 Hypercyclicity everywhere	31
2.1 Mixing operators	31
2.2 Existence of hypercyclic operators	37
2.3 Operators with prescribed orbits	41
2.4 There are many hypercyclic operators	44
2.5 There are few hypercyclic operators	47
2.6 Linear dynamics is complicated	49
2.7 Sums of hypercyclic operators	50
2.8 Comments and exercises	57
3 Connectedness and hypercyclicity	60
3.1 Connectedness and semigroups	61
3.2 Somewhere dense orbits	69
3.3 Comments and exercises	72
4 Weakly mixing operators	75
4.1 Characterizations of weak mixing	76
4.2 Hypercyclic non-weakly-mixing operators	83
4.3 Comments and exercises	92
5 Ergodic theory and linear dynamics	95
5.1 Gaussian measures and covariance operators	97
5.2 Ergodic Gaussian measures for an operator	107

vi	<i>Contents</i>	
	5.3	How to find an ergodic measure 111
	5.4	The results 117
	5.5	Examples 120
	5.6	Further results 124
	5.7	Comments and exercises 129
6	Beyond hypercyclicity	134
	6.1	Operators with d -dense orbits 134
	6.2	Chaotic operators 137
	6.3	Frequently hypercyclic operators 141
	6.4	Spaces without chaotic or frequently hypercyclic operators 150
	6.5	Almost closing the circle 153
	6.6	Comments and exercises 161
7	Common hypercyclic vectors	164
	7.1	Common hypercyclic vectors and transitivity 166
	7.2	Common hypercyclicity criteria 171
	7.3	A probabilistic criterion 179
	7.4	Paths of weighted shifts 185
	7.5	Comments and exercises 192
8	Hypercyclic subspaces	195
	8.1	Hypercyclic subspaces via basic sequences 196
	8.2	Hypercyclicity in the operator algebra 199
	8.3	Hypercyclic subspaces and the essential spectrum 205
	8.4	Examples 209
	8.5	Algebras of hypercyclic functions 213
	8.6	Comments and exercises 217
9	Supercyclicity and the Angle Criterion	218
	9.1	The Angle Criterion 218
	9.2	About the converse 219
	9.3	The Volterra operator 222
	9.4	Parabolic composition operators 224
	9.5	Comments and exercises 227
10	Linear dynamics and the weak topology	230
	10.1	Weakly closed and weakly dense sequences 231
	10.2	Weak dynamics of weighted shifts 241
	10.3	Unitary operators 253
	10.4	Weak sequential hypercyclicity and supercyclicity 259
	10.5	Comments and exercises 261
11	Universality of the Riemann zeta function	264
	11.1	Voronin's theorem and how to prove it 264
	11.2	Dirichlet series and the zeta function 268

<i>Contents</i>		vii
11.3	The first half of the proof	276
11.4	Some Hilbert space geometry	278
11.5	Density of Dirichlet polynomials	280
11.6	Unique ergodicity and the Kronecker flow	285
11.7	The second half of the proof	288
11.8	Comments and exercises	290
12	An introduction to Read-type operators	292
12.1	The strategy	292
12.2	First step	293
12.3	Second step	297
12.4	Third step	302
12.5	Comments and an exercise	308
<i>Appendices</i>		310
A	Complex analysis	310
B	Function spaces	311
C	Banach space theory	314
D	Spectral theory	316
<i>References</i>		321
<i>Notation</i>		331
<i>Author index</i>		333
<i>Subject index</i>		335