

Contents

<i>List of figures</i>	<i>page</i> viii
<i>List of tables</i>	ix
<i>Preface</i>	xi
1 Introduction	1
Part I Theory	
2 Basic concepts of game theory	9
2.1 Axioms of game theory	9
2.2 Game theoretic models	13
2.3 Dynamic games	21
2.4 Further reading	31
2.5 Exercises	35
3 Control theoretic methods	37
3.1 A simple optimal control problem	37
3.2 The Hamilton–Jacobi–Bellman equation	41
3.3 Pontryagin’s maximum principle	46
3.4 How to solve an optimal control problem	52
3.5 Information, commitment, and strategies	58
3.6 Infinite time horizon	61
3.7 Conditions for nonsmooth problems	74
3.8 Further reading	79
3.9 Exercises	80
4 Markovian equilibria with simultaneous play	84
4.1 The Nash equilibrium	84
4.2 Equilibrium conditions	92
4.3 Time consistency and subgame perfectness	98
	v

vi	Contents	
	4.4 Further reading	106
	4.5 Exercises	107
5	Differential games with hierarchical play	109
	5.1 Cournot and Stackelberg equilibria in one-shot games	109
	5.2 Open-loop Stackelberg equilibria	113
	5.3 Nondegenerate Markovian Stackelberg equilibria	134
	5.4 Further reading	141
	5.5 Exercises	142
	Appendix	144
6	Trigger strategy equilibria	146
	6.1 Non-Markovian strategies	146
	6.2 Acceptable profiles and effective threats	153
	6.3 Credible threats	161
	6.4 δ -strategies	165
	6.5 Further reading	168
	6.6 Exercises	168
7	Differential games with special structures	170
	7.1 Linear quadratic games	171
	7.2 Linear state games	187
	7.3 Exponential games	194
	7.4 Further reading	195
	7.5 Exercises	196
	Appendix	197
8	Stochastic differential games	201
	8.1 Piecewise deterministic games	201
	8.2 Differential games with white noise	226
	8.3 Further reading	236
	8.4 Exercises	236
Part II Applications		
9	Capital accumulation games	243
	9.1 The structure of capital accumulation games	244
	9.2 Qualitative properties of equilibrium strategies	246
	9.3 Stability properties of equilibria	253
	9.4 Games without adjustment costs	257
	9.5 Knowledge as a public good	260
	9.6 Further reading	264

Contents	vii
9.7 Exercises	265
10 Industrial organization and oligopoly games	267
10.1 Dynamic duopoly with sticky prices	267
10.2 A game of R&D competition	273
10.3 A game of R&D and resource extraction	278
10.4 Further reading	284
10.5 Exercises	285
11 Differential games in marketing	286
11.1 A duopolistic advertising game	286
11.2 An oligopoly game of new product pricing	295
11.3 Advertising goodwill accumulation	303
11.4 Further reading	308
11.5 Exercises	311
12 Differential games in resources and environmental economics	315
12.1 Nonrenewable resources	316
12.2 Nonrenewable resources: some variations	326
12.3 Renewable resources	331
12.4 A transboundary pollution game	338
12.5 Further reading	340
12.6 Exercises	341
Appendix	342
<i>Answers and hints for exercises</i>	344
<i>Bibliography</i>	365
<i>Index</i>	379