

Contents

List of Figures	xv
List of Tables	xvii
Preface	xix
Part I Optimization: Structure	
1 On the nondifferentiability of cone-monotone functions in Banach spaces	3
Jonathan Borwein and Rafal Goebel	
1.1 Introduction	3
1.2 Examples	6
References	13
2 Duality and a Farkas lemma for integer programs	15
Jean B. Lasserre	
2.1 Introduction	15
2.1.1 Preliminaries	16
2.1.2 Summary of content	17
2.2 Duality for the continuous problems \mathbf{P} and \mathbf{I}	18
2.2.1 Duality for \mathbf{P}	18
2.2.2 Duality for integration	19
2.2.3 Comparing \mathbf{P} , \mathbf{P}^* and \mathbf{I} , \mathbf{I}^*	19
2.2.4 The continuous Brion and Vergne formula	20
2.2.5 The logarithmic barrier function	21
2.2.6 Summary	22
2.3 Duality for the discrete problems \mathbf{I}_d and \mathbf{P}_d	22
2.3.1 The \mathbf{Z} -transform	23
2.3.2 The dual problem \mathbf{I}_d^*	24
2.3.3 Comparing \mathbf{I}^* and \mathbf{I}_d^*	24

2.3.4	The “discrete” Brion and Vergne formula	25
2.3.5	The discrete optimization problem \mathbf{P}_d	26
2.3.6	A dual comparison of \mathbf{P} and \mathbf{P}_d	27
2.4	A discrete Farkas lemma	29
2.4.1	The case when $A \in \mathbf{N}^{m \times n}$	30
2.4.2	The general case	31
2.5	Conclusion	33
2.6	Proofs	34
2.6.1	Proof of Theorem 1	34
2.6.2	Proof of Corollary 1	35
2.6.3	Proof of Proposition 3.1	36
2.6.4	Proof of Theorem 2	37
	References	38
3	Some nonlinear Lagrange and penalty functions for problems with a single constraint	41
	J. S. Giri and A. M. Rubinov	
3.1	Introduction	41
3.2	Preliminaries	43
3.3	The relationship between extended penalty functions and extended Lagrange functions	44
3.4	Generalized Lagrange functions	47
3.5	Example	51
3.5.1	The Lagrange function approach	51
3.5.2	Penalty function approach	52
	References	53
4	Convergence of truncates in l^1 optimal feedback control . .	55
	Robert Wenczel, Andrew Eberhard and Robin Hill	
4.1	Introduction	55
4.2	Mathematical preliminaries	58
4.3	System-theoretic preliminaries	60
4.3.1	Basic system concepts	60
4.3.2	Feedback stabilization of linear systems	62
4.4	Formulation of the optimization problem in l^1	64
4.5	Convergence tools	67
4.6	Verification of the constraint qualification	71
4.6.1	Limitations on the truncation scheme	76
4.7	Convergence of approximates	78
4.7.1	Some extensions	85
4.8	Appendix	88
	References	92

5 Asymptotical stability of optimal paths in nonconvex problems 95
 Musa A. Mamedov

5.1 Introduction and background 95

5.2 The main conditions of the turnpike theorem 97

5.3 Definition of the set \mathcal{D} and some of its properties 100

5.4 Transformation of Condition H3 101

5.5 Sets of 1st and 2nd type: Some integral inequalities 105

5.5.1 105

5.5.2 106

5.5.3 107

5.5.4 108

5.5.5 113

5.6 Transformation of the functional (5.2) 117

5.6.1 117

5.6.2 119

5.7 The proof of Theorem 13.6 123

5.7.1 123

5.7.2 129

References 133

6 Pontryagin principle with a PDE: a unified approach 135
 B. D. Craven

6.1 Introduction 135

6.2 Pontryagin for an ODE 136

6.3 Pontryagin for an elliptic PDE 138

6.4 Pontryagin for a parabolic PDE 139

6.5 Appendix 140

References 141

7 A turnpike property for discrete-time control systems in metric spaces 143
 Alexander J. Zaslavski

7.1 Introduction 143

7.2 Stability of the turnpike phenomenon 146

7.3 A turnpike is a solution of the problem (P) 149

7.4 A turnpike result 151

References 155

8 Mond–Weir Duality 157
 B. Mond

8.1 Preliminaries 157

8.2 Convexity and Wolfe duality 158

8.3 Fractional programming and some extensions of convexity 159

8.4	Mond–Weir dual	160
8.5	Applications	160
8.6	Second order duality	162
8.7	Symmetric duality	163
	References	165
9	Computing the fundamental matrix of an $M/G/1$-type Markov chain	167
	Emma Hunt	
9.1	Introduction	167
9.2	Algorithm H: Preliminaries	170
9.3	Probabilistic construction	172
9.4	Algorithm \bar{H}	174
9.5	Algorithm \bar{H} : Preliminaries	175
9.6	\bar{H} , \mathbf{G} and convergence rates	178
9.7	A special case: The QBD	181
9.8	Algorithms CR and H	185
	References	187
10	A comparison of probabilistic and invariant subspace methods for the block $M/G/1$ Markov chain	189
	Emma Hunt	
10.1	Introduction	189
10.2	Error measures	190
10.3	Numerical experiments	192
	10.3.1 Experiment G1	193
	10.3.2 Experiment G2	194
	10.3.3 The Daigle and Lucantoni teletraffic problem	196
	10.3.4 Experiment G6	201
	10.3.5 Experiment G7	202
	References	204
11	Interpolating maps, the modulus map and Hadamard’s inequality	207
	S. S. Dragomir, Emma Hunt and C. E. M. Pearce	
11.1	Introduction	207
11.2	A refinement of the basic inequality	210
11.3	Inequalities for G_f and H_f	216
11.4	More on the identric mean	217
11.5	The mapping L_f	220
	References	223

Part II Optimization: Applications

12 Estimating the size of correcting codes using extremal graph problems 227
 Sergiy Butenko, Panos Pardalos, Ivan Sergienko, Vladimir Shylo and Petro Stetsyuk

12.1 Introduction 227

12.2 Finding lower bounds and exact solutions for the largest code sizes using a maximum independent set problem 229

12.2.1 Finding the largest correcting codes 232

12.3 Lower Bounds for Codes Correcting One Error on the Z-Channel 236

12.3.1 The partitioning method 237

12.3.2 The partitioning algorithm 239

12.3.3 Improved lower bounds for code sizes 239

12.4 Conclusions 241

References 242

13 New perspectives on optimal transforms of random vectors 245
 P. G. Howlett, C. E. M. Pearce and A. P. Torokhti

13.1 Introduction and statement of the problem 245

13.2 Motivation of the statement of the problem 247

13.3 Preliminaries 248

13.4 Main results 249

13.5 Comparison of the transform T^0 and the GKLT 251

13.6 Solution of the unconstrained minimization problem (13.3) . 252

13.7 Applications and further modifications and extensions 253

13.8 Simulations 254

13.9 Conclusion 258

References 258

14 Optimal capacity assignment in general queueing networks 261
 P. K. Pollett

14.1 Introduction 261

14.2 The model 262

14.3 The residual-life approximation 263

14.4 Optimal allocation of effort 264

14.5 Extensions 267

14.6 Data networks 268

14.7 Conclusions 271

References 271

15 Analysis of a simple control policy for stormwater management in two connected dams 273
 Julia Piantadosi and Phil Howlett

15.1 Introduction 273

15.2 A discrete-state model 274

 15.2.1 Problem description 274

 15.2.2 The transition matrix for a specific control policy . . 275

 15.2.3 Calculating the steady state when $1 < m < k$ 276

 15.2.4 Calculating the steady state for $m = 1$ 279

 15.2.5 Calculating the steady state for $m = k$ 280

15.3 Solution of the matrix eigenvalue problem using Gaussian elimination for $1 < m < k$ 280

 15.3.1 Stage 0 281

 15.3.2 The general rules for stages 2 to $m - 2$ 281

 15.3.3 Stage $m - 1$ 283

 15.3.4 The general rules for stages m to $k - 2m$ 284

 15.3.5 Stage $k - 2m + 1$ 285

 15.3.6 The general rule for stages $k - 2m + 2$ to $k - m - 2$ 286

 15.3.7 The final stage $k - m - 1$ 287

15.4 The solution process using back substitution for $1 < m < k$. 287

15.5 The solution process for $m = 1$ 290

15.6 The solution process for $m = k$ 292

15.7 A numerical example 292

15.8 Justification of inverses 295

 15.8.1 Existence of the matrix W_0 296

 15.8.2 Existence of the matrix W_p for $1 \leq p \leq m - 1$ 296

 15.8.3 Existence of the matrix W_q for $m \leq q \leq k - m - 1$ 298

15.9 Summary 305

References 306

16 Optimal design of linear consecutive- k -out-of- n systems . 307
 Małgorzata O'Reilly

16.1 Introduction 307

 16.1.1 Mathematical model 307

 16.1.2 Applications and generalizations of linear consecutive- k -out-of- n systems 308

 16.1.3 Studies of consecutive- k -out-of- n systems 309

 16.1.4 Summary of the results 311

16.2 Propositions for R and M 312

16.3 Preliminaries to the main proposition 315

16.4 The main proposition 318

16.5 Theorems 321

16.6	Procedures to improve designs not satisfying necessary conditions for the optimal design	324
	References	325
17	The $(k+1)$-th component of linear consecutive-k-out-of-n systems	327
	Małgorzata O'Reilly	
17.1	Introduction	327
17.2	Summary of the results	329
17.3	General result for $n > 2k, k \geq 2$	330
17.4	Results for $n = 2k + 1, k > 2$	334
17.5	Results for $n = 2k + 2, k > 2$	337
17.6	Procedures to improve designs not satisfying the necessary conditions for the optimal design	340
	References	341
18	Optimizing properties of polypropylene and elastomer compounds containing wood flour	343
	Pavel Spiridonov, Jan Budin, Stephen Clarke and Jani Matisons	
18.1	Introduction	344
18.2	Methodology	344
	18.2.1 Materials	344
	18.2.2 Sample preparation and tests	345
18.3	Results and discussions	345
	18.3.1 Density of compounds	345
	18.3.2 Comparison of compounds obtained in a Brabender mixer and an injection-molding machine	346
	18.3.3 Compatibilization of the polymer matrix and wood flour	349
	18.3.4 Optimization of the compositions	350
18.4	Conclusions	352
	References	353
19	Constrained spanning, Steiner trees and the triangle inequality	355
	Prabhu Manyem	
19.1	Introduction	355
19.2	Upper bounds for approximation	359
	19.2.1 The most expensive edge is at most a minimum spanning tree	359
	19.2.2 MaxST is at most $(n - 1)$ MinST	359
19.3	Lower bound for a CSP approximation	360
	19.3.1 E-Reductions: Definition	360
	19.3.2 SET COVER	361
	19.3.3 Reduction from SET COVER	361
	19.3.4 Feasible Solutions	362

19.3.5	Proof of E-Reduction	365
19.4	Conclusions	366
	References	366
20	Parallel line search	369
	T. C. Peachey, D. Abramson and A. Lewis	
20.1	Line searches	369
20.2	Nimrod/O	370
20.3	Execution time	373
20.3.1	A model for execution time	373
20.3.2	Evaluation time a Bernoulli variate	373
20.3.3	Simulations of evaluation time	375
20.3.4	Conclusions	375
20.4	Accelerating convergence by incomplete iterations	377
20.4.1	Strategies for aborting jobs	377
20.4.2	Experimental results	378
20.4.3	Conclusions	381
	References	381
21	Alternative Mathematical Programming Models: A Case for a Coal Blending Decision Process	383
	Ruhul A. Sarker	
21.1	Introduction	383
21.2	Mathematical programming models	385
21.2.1	Single period model (SPM)	386
21.2.2	Multiperiod nonlinear model (MNM)	389
21.2.3	Upper bound linear model (MLM)	390
21.2.4	Multiperiod linear model (MLM)	391
21.3	Model flexibility	392
21.3.1	Case-1	392
21.3.2	Case-2	394
21.3.3	Case-3	395
21.4	Problem size and computation time	395
21.5	Objective function values and fluctuating situation	396
21.6	Selection criteria	397
21.7	Conclusions	398
	References	398
	About the Editors	401



<http://www.springer.com/978-0-387-98095-9>

Optimization

Structure and Applications

(Eds.) C.E.M. Pearce; E. Hunt

2009, XVI, 434 p. 21 illus., Hardcover

ISBN: 978-0-387-98095-9