CONTENTS

Mathematical Programming Methodology	1
Basic Issues in Lagrangian Optimization R.T. Rockafellar	3
 Formulation of optimization problems Optimality conditions 	3 8
3. Extended problem models	17
Dynamic Programming - Basic Concepts and Applications K . $Neumann$	31
1. Deterministic dynamic programming	31
2. Stochastic dynamic programming	45
Interior Point Methodology for Linear Programming: Duality, Sensitivity Analysis and Computational Aspects B. Jansen, C. Roos, T. Terlaky, JPh. Vial	57
1. Introduction	58
2. A new approach to the theory of linear programming	60
3. Parametric analysis	81
4. A primal-dual interior point algorithm	99
5. Implementation	110
6. Conclusions	118
Approaches to Stochastic Programming with Application to Electric Power Systems G.B. Dantzig, G. Infanger	125
1. Introduction	125
2. Two-stage stochastic linear programs	126
3. Multi-stage stochastic linear programs	127
4. Multidimensional integration	129
5. Importance sampling	130
6. Benders decomposition	133
7. Implementation	134
8. Conclusion	137



Ι

II	Unit Commitment	141
	Unit Commitment and Thermal Optimization - Problem Statement H. Braun	143
	1. Introduction	144
	2. The planning tasks in the electric energy supply	148
	3. Structure of the power systems	152
	4. Long-term planning	152
	5. Short term operational planning	159
	6. Summary and outlook	168

Experiences with Optimization Packages	173
for Unit Commitment	
H. Sanders, K. Linke	
1. Introduction	173
2. Load modelling	174
3. Generation modelling	176

•	
VEW optimization levels	17
Annual optimization	18
Medium term planning	18
Conclusions and consequences	19
	Annual optimization Medium term planning

Modelling in Hydro-Thermal Optimization	
A. Schadler, E. Steinbauer	
1. Problem definition	199
2. Modelling	205

3.	Optimization	209
4.	Computational experience	211

III	Optimal Power Flow	215
	Power System Models, Objectives and Constraints in Optimal Power Flow Calculations R. Bacher	217
	1. Introduction	218
	2. The role of the optimal power flow (OPF) computation within the overall power system control	220
	3. The power flow model as equality constraint set of the OPF	223
	4. Mathematical formulation of operational constraints	233
	5. OPF objectives and objective functions	247
	6. The complete OPF formulation	252
	Use of Linear and Quadratic Programming Techniques in Exploiting the Nonlinear Features of the Optimal Power Flow H. Glavitsch	265
	1. Introduction	266
	2. Characteristics of the nonlinearities	267
	3 Incremental forms of system relations	971

4. Solution concepts and considerations on the choice of a method 277

281

283

288

292

298

299

299

5. Economic dispatch - a sample problem

6. Linear programming as a solution method

8. Dual method of quadratic programming

10. The Newton optimal power flow

11. Concluding remarks

7. Use of a standard quadratic programming method

9. Loss minimization by reactive optimization based on LP

Optimal Power Flow Packages - Requirements and Experiences A. Papalexopoulos	309
1. Introduction	310
2. Overview of the OPF problem	312
3. Operational requirements for an on-line OPF implementation	317
4. Experience with OPF packages in a practical environment	338
5. Conclusions	344
Cost/Benefits Analysis of the Optimal Power Flow K. Kato	349
1. Introduction	350
2. Approximate analysis	350
3. Accurate analysis	351
4. Conclusions	364