

Contents

Foreword by <i>Martin L. Weitzman</i>	iii
Preface	v
Introduction	1
Part I REVIEW OF CONTEMPORARY METHODS OF MATHEMATICAL PROGRAMMING	11
1. General Methods for Solving Extremum Problems and Systems of Equations	13
1.1 Some notions of the general theory of extremum problems and systems of equations	13
1.2 Methods of unconstrained optimization	17
1.3 Methods of constrained optimization	28
2. Decomposition Methods	35
2.1 Nature of decomposition methods and problems in constructing effective algorithms	35
2.2 Algorithms that approximate the set of feasible solutions of the local problems	39
2.3 Algorithms of direct distribution of resources that convert global constraints into local constraints at each iteration	51
2.4 Elastic resource allocation algorithms with global constraints appended to the objective function	59
Part II ITERATIVE AGGREGATION ALGORITHMS FOR SOLVING SYSTEMS OF EQUATIONS	69
3. Iterative Aggregation Algorithms for Solving Systems of Interproduct Input-Output Model Equations	71
3.1 Input-output model with values of products in fixed prices and the model with values of products in physical units	72

3.2	Basic two-level iterative aggregation algorithm for interproduct input-output model with values of products in fixed prices	74
3.3	Basic one-level iterative aggregation algorithm for interproduct input-output model with values of products in fixed prices	80
3.4	Iterative aggregation algorithms for the solution of interproduct input-output model with values of products in physical units	82
3.5	Two-level iterative aggregation processes with the minimizations of imbalances in a semiaggregate problem	89
3.6	Generalizations of the basic algorithms; their variations and modifications	98
3.7	Simplest conversion of iterative aggregation algorithms for interproduct input-output model into provably convergent algorithms	106
Appendix 3.1	Mathematical analysis of basic iterative aggregation algorithms for interproduct input-output models	109
Appendix 3.2	Investigation of convergence of iterative aggregation algorithms with Manove-Weitzman approximations of von Neumann prices	119
Appendix 3.3	On the convergence of the two-level iterative aggregation algorithm that uses imbalances minimization criterion in a semiaggregate problem	125
Appendix 3.4	Mathematical analysis of the generalizations, variants, and modifications of the basic iterative aggregation algorithms for interproduct input-output models	126
4.	Iterative Aggregation Algorithms for Solving General Linear Systems	133
4.1	Two-level iterative aggregation algorithms with minimization of imbalances in a semiaggregate problem	133
4.2	One-level iterative aggregation algorithms with minimization of imbalances in a semiaggregate problem	136
4.3	Two-level algorithms with minimization of imbalances and aggregation of increments	137

4.4	One-level algorithms with minimization of imbalances and aggregation of increments	140
4.5	Numerical experiments with iterative aggregation algorithms for linear systems of equations	141
4.6	Iterative aggregation algorithms for optimal interproduct input-output models	147
Appendix 4.1	On the convergence of iterative aggregation algorithms for general linear systems of equations	152
Appendix 4.2	Mathematical analysis of those iterative aggregation algorithms for the optimal interproduct input-output model which use the interindustry problem	155
Appendix 4.3	Mathematical analysis of those iterative algorithms for the optimal interproduct input-model which use minimizing imbalances in a semiaggregate problem	159
Part III	ITERATIVE AGGREGATION ALGORITHMS FOR SOLVING EXTREMUM PROBLEMS	161
5.	Iterative Aggregation Methods for Solving Unconstrained Optimization Problems	163
5.1	Two-level iterative aggregation algorithms	163
5.2	One-level iterative aggregation algorithms for unconstrained optimization problems	170
5.3	Iterative aggregation algorithms based on conjugate gradient methods	172
Appendix 5.1	Convergence of iterative aggregation algorithms for unconstrained optimization problems	183
Appendix 5.2	Mathematical theory of conjugate subspaces algorithm for the case of quadratic functions	186
6.	Iterative Aggregation Algorithms for Constrained Optimization Problems	194
6.1	Applications of iterative aggregation algorithms for unconstrained optimization to constrained optimization problems with variables aggregation	194

6.2	One-sided iterative aggregation algorithms for solving convex programming problems with constraints aggregation	197
6.3	Two-level iterative aggregation algorithms with both variables and constraints aggregation	205
6.4	One-level iterative aggregation algorithms with both variables and constraints aggregation	210
6.5	General scheme of two-level iterative aggregation algorithms for constrained optimization problems	215
6.6	General scheme of one-level iterative aggregation algorithms for constrained optimization problems	231
Appendix 6.1	On the convergence of one-sided iterative aggregation algorithms (constraints aggregation)	234
Appendix 6.2	Mathematical theory of the two-level algorithm with both constraints and variables aggregation	248
References		263
Index		271